PLACER LEGACY

STREAMS OF WESTERN PLACER COUNTY:

AQUATIC HABITAT AND BIOLOGICAL RESOURCES

LITERATURE REVIEW

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SIERRA BUSINESS COUNCIL

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Western Placer Streams Literature Review

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*Numbers apply to pages in PDF document of full report.

INTRODUCTION

The purpose of this report is to provide a summary of the pertinent literature (subject to time limitations; an assessment of the quality and quantity of data available for several important types of parameters (e.g., water temperature, habitat quality; water quality, etc.); and an overall assessment of the general condition of the stream to support anadromous salmonids, adequacy of the data to support specific decisions regarding the stream's potential to support anadromous, and a list of factors that should be considered in the Habitat Conservation Planning process.

This literature review and assessment is focused on the following general areas that are important to understanding the current condition of the stream and assessing its potential as an anadromous fish stream:

- Existing Water Quality Data
- Water Temperature Data
- Benthic Macroinvertebrate Data
- Physical Habitat Data
- Fishery Resource Data
- Fish Passage or Screening Data

METHODS

The data and information used to prepare the data summaries and overall assessment of stream conditions are from a variety of sources. Limitations on the time available to conduct the literature review precluded an exhaustive search of all possible data sources. I have concentrated on reviewing California Department of Fish and Game files, data and sampling efforts conducted by the various watershed groups, and environmental documents prepared by the various jurisdictions that include information about this watershed.

Where the amount of data from a particular source was small, I incorporated all of the relevant information completely in this report. In cases where the volume of data was large, I summarized the data into what I considered meaningful units. This is particularly true for the water temperature data. Where data is presented, the source has been documented within the presentation. This allows the reader to immediately understand where the data or information originated. In addition to the data and information presented, I also reviewed the VHS tape of the stream videography project to provide additional visual assessment of the watershed for the areas flown.

Although the data were to be submitted in an Excel spreadsheet format to the Sierra Business Council and County of Placer, my review has found very little information that is in electronic format. Also, much of the data is scattered in various files with just snippets of information in a single location. Where possible, I have included electronic copies of the data to the County under separate cover. This is particularly true of the water temperature data from the continuous monitoring sites (this data has already been transmitted to the County). Some other data sources may be electronic format, but may not be transmitted to the County because of the limited nature and overall usefulness, unless the County decides otherwise (e.g., water quality and benthic macroinvertebrate data).

Water Temperature

Since daily maximum, minimum, and/or mean temperatures individually are of little value, I have chosen to plot all data points. Therefore, I have split the year into time periods that roughly correspond to:

> **Fall-early winter:** September though December: primary fall chinook spawning period is November-December.
> **Winter-spring:** January though April: fall chinook incubation and rearing and steelhead spawning, incubation, and rearing.
> **Late spring-summer:** May to September: summer rearing for steelhead juveniles.

Data plots for these time periods are presented below to allow the reader to assess the potential of Dry Creek to support chinook salmon and/or steelhead trout spawning and rearing. A variety of localized data and literature was reviewed, in order to get some generalized understanding of the temperature effects on various life history stages for both chinook salmon and steelhead trout. There is fairly substantial variation in temperature effects noted for most life history stages. However, the reader is reminded that both chinook and steelhead are have a highly adaptable physiology and ability to seek thermal refuge during part of the day which allows them to tolerate and/or avoid lethal temperatures. Some of the literature sources cite criteria from others and some of the data is based on fish captures with water temperature taken concurrently. Two tables with data and reference are included in Appendix A of this report. Based on this review, the following criteria have been used to indicate what life history stages a particular stream may support at any given time:

Chinook Salmon	**^{O}C**	**Steelhead Trout**	**^{O}C**
Egg and fry development	14.4 (58 ^{O}F)	Egg and fry development	14.4 (58 ^{O}F)
Juvenile rearing	21.1 (70 ^{O}F)	Juvenile rearing	22.2 (72 ^{O}F)
Adult migration	21.7 (71 ^{O}F)	Adult migration and holding	22.2 (72 ^{O}F)

To aid the reader, I have placed reference lines, as appropriate, on the graphics at 14.4 ^{O}C and at 22.2 ^{O}C to roughly represent the water temperatures suitable for salmonid spawning migration, egg and fry development, and juvenile rearing.

ANTELOPE CREEK/CLOVER VALLEY CREEK

A. Water Quality Data

1. 1959 Foot Survey from Roseville to Rocklin (Atlantic Street? To Sunset Blvd.?): On October 7, 1959 a foot survey was conducted from what the surveyor described as N. Main Street in Roseville to about 1 mile upstream of the Rocklin-Loomis Wastewater Treatment Plant. Checking an old topographic map and current maps, it appears that this survey covered the stream from about Atlantic Street in Roseville to Sunset Blvd. in Rocklin. The former Rocklin-Loomis Wastewater Treatment Plant was located about where Highway 65 now crosses over Antelope Creek. This survey reported the following results: **Source: California Department of Fish and Game, Region 2 files.**

Table 1. Water quality data from a one-time foot survey from Roseville to Rocklin on 10/7/1959. Note the high pH reading in the stream.

Station	Time	Water Temp	Dissolved Oxygen	pH	Flow (cfs)
N. Main St. [Atlantic Street?]	1330	60	10.2	--	4
½ Mile Upstream	1400	60	10.0	--	4
Rocklin-Loomis WWTP	1430	60	10.4	8.6	4
1 Mile Upstream [Sunset Blvd.?]	1530	60	9.0	--	4

Source: California Department of Fish and Game, Region 2 files**.**

2. 2001 and Periodic Water Quality Sampling: Periodic water quality information has been collected for several sites in the Antelope Creek Watershed since December of 2000. During 2001, the Central Valley Regional Water Quality Control Board (Regional Board) staff conducted monthly monitoring near the Sierra College Blvd. crossing and Sunset Boulevard crossing in Rocklin. The Dry Creek Conservancy (DCC) has conducted periodic "first flush" monitoring at Sierra College Blvd., Atlantic Ave., and in Clover Valley Creek. A variety of parameters are collected, but the data set is not comprehensive or systematic for all parameters. The Regional Board collections also included pesticide scans with no problems noted. Metals data indicate that concentrations of copper in samples collected in November 2001 exceeded drinking water quality standards (Table 2) at a water hardness of 50 mg/l (Table 3). While no hardness measurements were taken at the time of sampling, contemporary measurements indicate that hardness must have been near 50-60 mg/l. Data on hardness in the stream over the course of the one-year of monthly monitoring ranged from 24-98 mg/l, which demonstrate that the water quality standards at a hardness of 50 mg/l are applicable. Antelope Creek and Clover Valley Creek also showed measurable concentrations of barium on 11/13/2001. While no standard exists for barium, it is an indicator of industrial pollution.

Table 2. California Toxics Rule water quality standards for selected metals, based on a hardness of 50 mg/l as CaCO3.

Metal	Maximum Concentration (Acute) (mg/l)	Continuous Concentration (Chronic) (mg/l)
Barium	No standard	No standard
Cadmium	0.002	0.0013
Copper	0.007	0.005
Zinc	0.067	0.066

Source: California Toxics Rule (water quality objectives)

Table 3. Metal concentration data from three locations in the Antelope Creek Watershed. This data shows that copper concentrations exceed the California Toxics Rules standards calculated for a hardness of 50 mg/l as CaCO3.

Stream	Location	Date	Barium mg/l	Copper mg/l*	Zinc mg/l	Notes
Antelope Creek	Sierra College Blvd.	11/13/01	0.055	**0.007**	0.018	Hardness ≈ 60 mg/l
Antelope Creek	Atlantic Ave.	11/13/01	0.059	**0.007**	0.015	Hardness ≈ 50 mg/l
Antelope Creek	Atlantic Ave.	11/08/02	ND	ND	0.039	
Antelope Creek	Clover Valley Ck. Tributary	11/13/01	0.056	ND	0.007	

* Values in bold exceed California Toxics Rule objectives for aquatic life at a hardness of 50 mg/l.
Sources: California Toxics Rule (water quality objectives); Central Valley Regional Water Quality Control Board; Dry Creek Conservancy, unpublished data.

Selected water quality data of interest for aquatic systems is presented in Appendix Antelope Creek 1 of this chapter. These data were selected for inclusion here because of their overall importance in stream productivity and to identify any potential nutrient or water quality problems that may adversely affect aquatic species. A complete set of all water quality data is available electronically from the DCC, while Bailey Environmental has a complete copy of the provisional data. Figure 1 displays data from the four locations sampled within the watershed and shows unusual swings in pH values that were also observed in nearby streams. The cause of these fluctuations is unknown but of concern and should be evaluated further.

Appendix Antelope Creek 1 also contains limited data on concentrations of nitrate nitrogen (NO_3) and orthophosphate (PO_4). These data indicate that the biologically desirable ratio of nitrate to phosphate of 10:1 is not present in this stream. Figure 2 shows the mean values recorded in the various samplings; in general, the ratio of NO_3 to PO_4 is much lower than 10:1. Although the overall concentrations of these constituents can be low, there are concentrations recorded in which biostimulation could become a major concern, particularly in downstream areas. The data generally show that this stream has low values of hardness and alkalinity, which equates to lower levels of productivity. However, an increase in runoff and/or nutrient levels could begin to cause water quality problems.

Figure 1. Composite pH data from four sites in the Antelope Creek Watershed showing unusual annual variations in pH at individual locations.

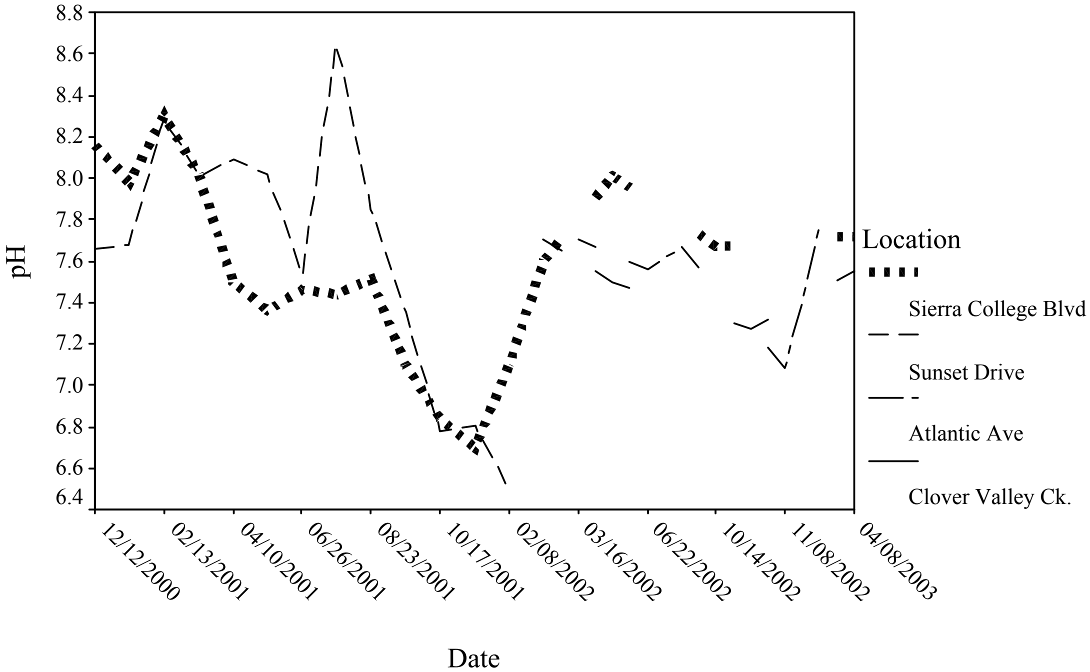
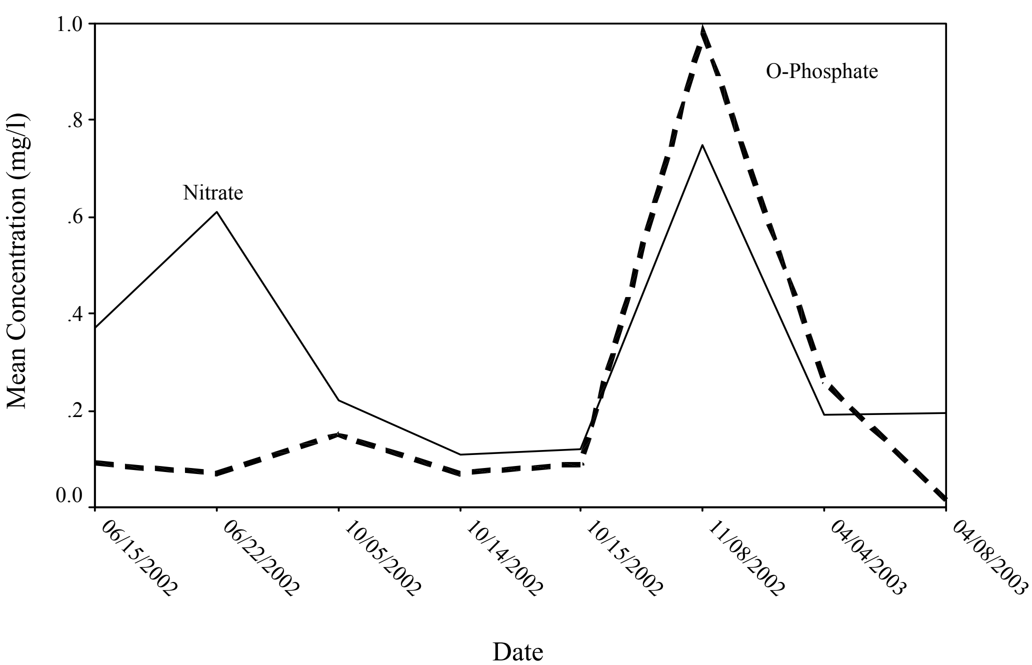


Figure 2. Comparison of mean nitrate nitrogen and orthophosphate concentrations recorded in the Antelope Creek Watershed.



B. Water Temperature Data

Water temperature data are limited, with some data from two-year monitoring at locations near Sierra College Blvd. and Sunset Blvd. (Figure 3) conducted by Central Valley Regional Water Quality Control Board staff. Additional information is spot data, usually taken quarterly during water quality sampling by members of the Dry Creek Conservancy. Most of the data come from hourly monitoring funded by Placer County and conducted by Bailey Environmental. This sampling was initiated in late May 2003 and will continue for approximately one year. All data retrieved to date are plotted in Figures 4-6 below. Since daily maximum, minimum, and/or mean temperatures individually are of little value, I have chosen to plot all data points. Therefore, I have split the year into time periods that roughly correspond to:

Fall-early winter: September though December; primary fall-run chinook spawning period is November-December.
Winter-spring: January though April; fall-run chinook incubation and rearing and steelhead spawning, incubation, and rearing.
Late spring-summer: May to September; summer rearing for steelhead juveniles.

Data plots for these time periods are presented below to allow the reader to assess the potential of Antelope Creek to support chinook salmon and/or steelhead trout spawning and rearing. A variety of localized data and literature was reviewed in order to get some generalized understanding of the temperature effects on various life history stages for both chinook salmon and steelhead trout. There is fairly substantial variation in temperature effects noted for most life history stages. However, both chinook salmon and steelhead are have a highly adaptable physiology and ability to seek thermal refuge during part of the day, which may allow them to tolerate and/or avoid lethal temperatures. Some of the literature sources cite criteria from others and some of the data is based on fish captures with water temperature taken concurrently. Two tables with data and reference are included in Appendix A of this report. Based on this review, the following criteria have been used to indicate what life history stages a particular stream may support at any given time:

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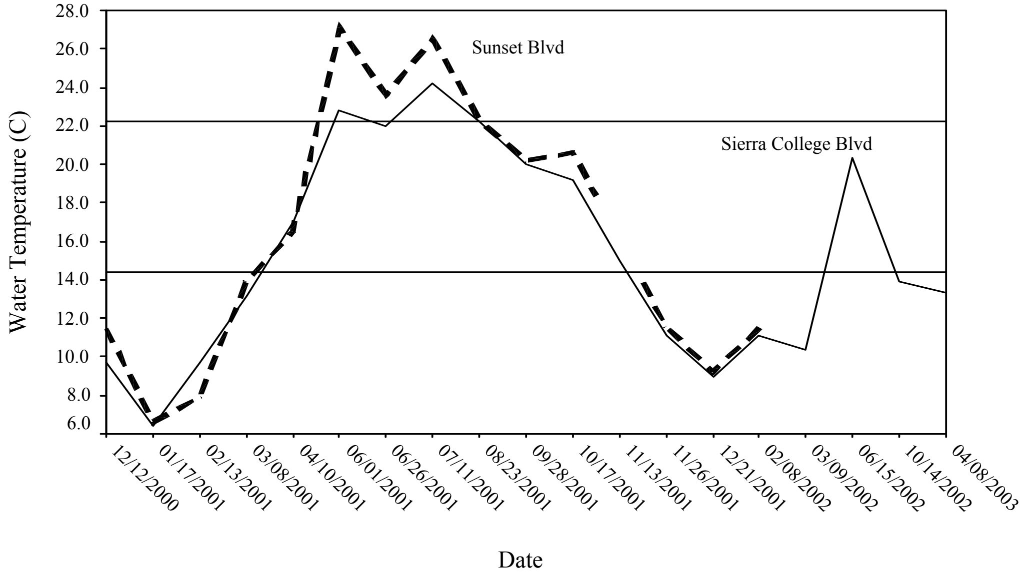
Adult migration	21.7 (71 ^{O}F)	Adult migration and holding	22.2 (72 ^{O}F)

These reported temperature thresholds are plotted as reference lines, as appropriate, on figures 3-6 to roughly represent the water temperatures suitable for salmonid spawning migration, egg and fry development, and juvenile rearing.

1. December 2000 through 2001 And Subsequent Quarterly Sampling: Figure 3 displays data collected primarily monthly at Sierra College Blvd and Sunset Blvd. and some subsequent data from quarterly water quality sampling. Some quarterly data is available for an Atlantic Ave. station and a station in Clover Valley Creek. **Source: Unpublished data from Dry Creek Conservancy and Regional Water Quality Control Board staff.**

Figure 3. Periodic water temperature data for Antelope Creek from stations located near Sierra College Blvd. and Sunset Blvd. in Rocklin. These data are spot samples and may not adequately represent the temperature conditions for anadromous fish. Thermal refugia may exist.



2. Water Temperature Information from Bailey Environmental April 1999 to August 2003: In May 2003, Placer County contracted to add additional stations on Antelope Creek. Stations were added at the Antelope Creek Drive crossing, 311 Sunset Blvd. in the City of Rocklin, and at the Myers residence near Midas Avenue. Figures 4-6 display all of the data to date.

Figure 4. Water temperature time series for Antelope Creek at the Antelope Creek Drive crossing, during the period May 29 through August 4, 2003. Temperatures are marginal for juvenile rearing. Someone taking the sensor in and out of the stream is responsible for the missing data.

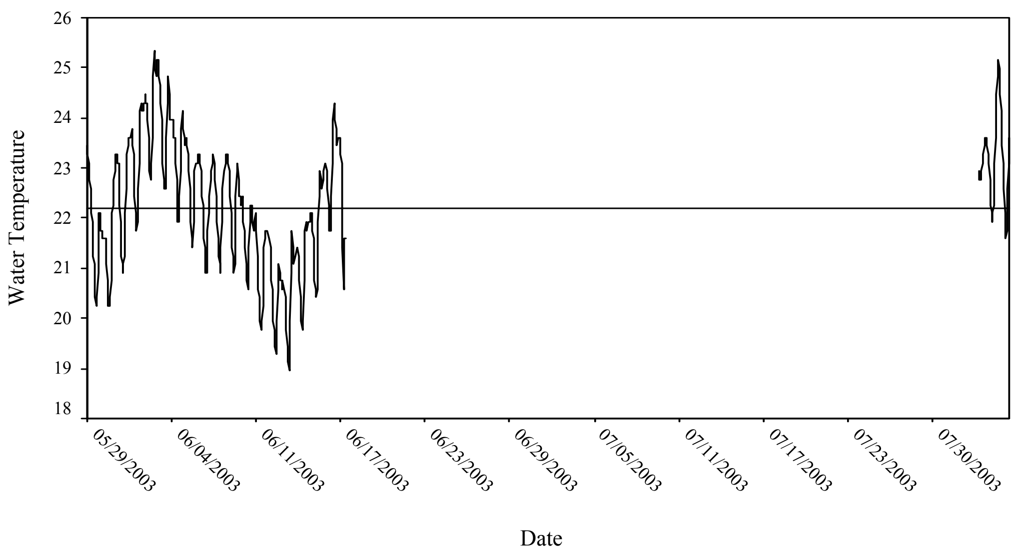


Figure 5. Water temperature time series for Antelope Creek at the 311 Sunset Blvd. station, during the period May 29 through August 4, 2003. Temperatures are marginal for juvenile rearing.

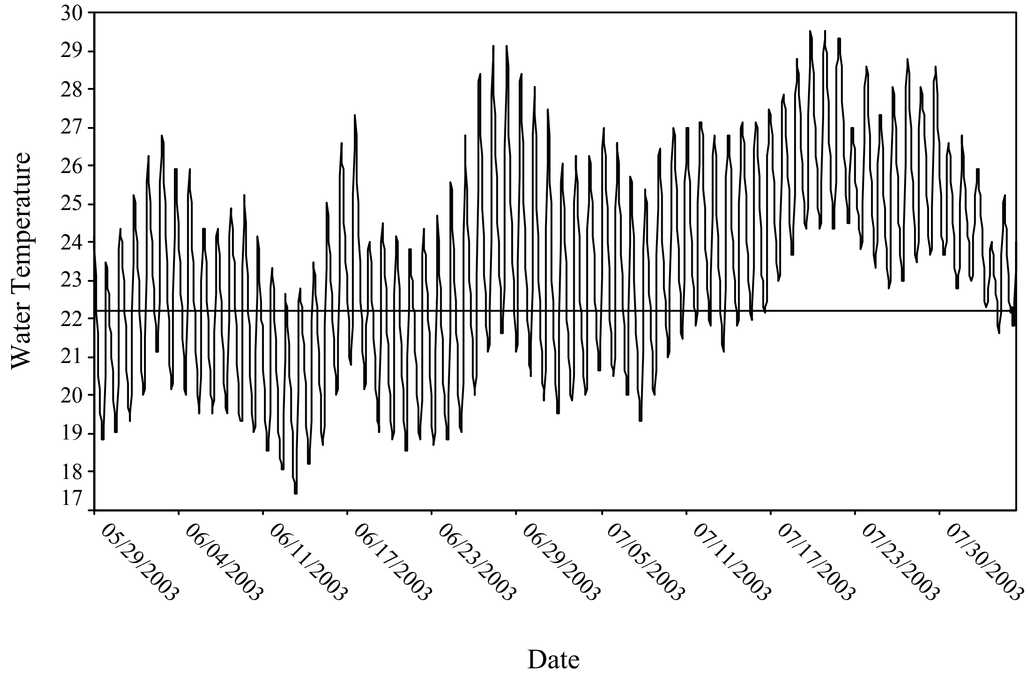
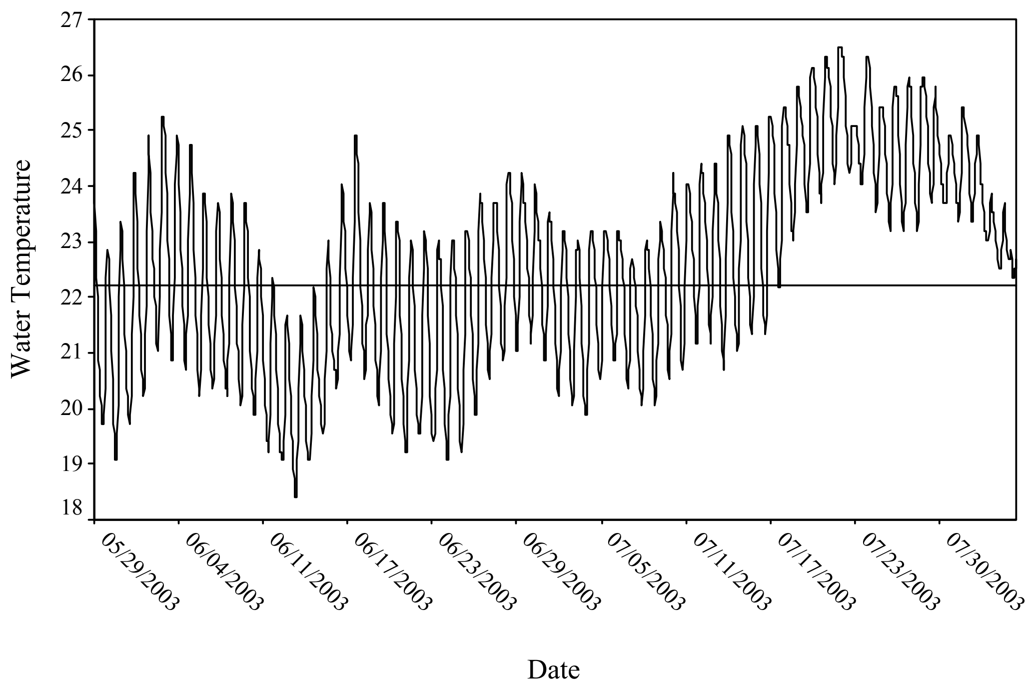


Figure 6. Water temperature time series for Antelope Creek at the Myers residence station, during the period May 29 through August 4, 2003. Temperatures are marginal to suitable for juvenile rearing.



C. Benthic Invertebrate Data

Members of the Dry Creek Conservancy conduct the sampling program for benthic macroinvertebrates. Sampling data from 2000 at a single and unidentified site in Antelope Creek, two sampling sites in Antelope Creek (Atlantic Avenue and King Road) and two sites in Clover Valley Creek (Park, and Taglio) in 2001 are presented in Appendix Antelope Creek 2. These data indicate that Antelope Creek and particularly Clover Valley Creek have an extremely limited aquatic insect population. Also, the data indicate a high percentage of pollution tolerant organisms, with almost no taxa associated with cleaner waters. These results are not unexpected given the urban nature of the stream and the amount of sediment deposited in the channels of both streams. **Source: Dry Creek Conservancy, unpublished data.**

D. Physical Habitat Data

Physical habitat data are limited to three sources for Antelope Creek's mainstem:

1. **1992-1993 Habitat Inventory by David Vanicek, Professor at California State University, Sacramento:** The habitat inventory was limited to two reaches in Antelope Creek. An explanation of the terminology used in the reach descriptions follows the actual descriptions. The first is described as a 700 m reach from the confluence with Dry Creek upstream to the Southern Pacific Railroad Crossing. The second reach started at the Railroad Crossing and covered approximately 875 m of channel. Vanicek describes the reaches as follows:

> Reach 1: Mostly flatwater; a few 3rd class and one 1st class pools; appears to be recovering from disturbances caused by bridge and road construction; two possible spawning sites; overall quality: 2.
>
> Reach 2: Mostly flatwater: a few pools, mostly 3rd class; very few riffles; mostly sand and silt substrate; some cover from overhanging banks; little canopy; several possible barriers at low flows; shallow riffles and debris dams; overall quality: 2.
>
> Vanicek defines flatwater as the same as would be considered a glide in most other methodologies. A 1st class pool is large and deep with more than 30% of the stream bottom obscured, etc., or a maximum depth of > 1.5m. A 3rd class pool is described as small in area or shallow or both. Depth and velocity are sufficient to provide a low velocity holding area for a few adult salmon. **Source: Fisheries Habitat Evaluation Dry Creek, Antelope Creek, Secret Ravine, and Miners Ravine (Task I); Prepared for EIP Associates by C. David Vanicek, CSUS Hornet Foundation, August 1993, Copy from CDFG files, Region 2.**

2. 2002 Foot Survey by Randy Bailey, Bailey Environmental: During November and December of 2002, I conducted foot surveys for chinook salmon from the bridge at Antelope Creek Drive downstream to the confluence with Dry Creek, a distance of approximately 1.8 miles. The purpose of the surveys was to supplement surveys being conducted by the Dry Creek Conservancy. I began at the bridge crossing on Antelope Creek Drive. Immediately upstream of the bridge was an impassible beaver dam that remained in place all winter long. I observed a stream channel that is within the City of Roseville's Greenway area and is developing a substantial riparian vegetation community. Beavers are active in this reach of stream and there is ample evidence of their impacts. The stream bottom is covered with an excessive load of sediment that appears to be decomposed granite in origin. The channel does have a reasonably good meander pattern, with bank erosion occurring in some locations. The soil banks along the stream in this location are more dirt and clay, rather than granite. There is a substantial amount of large woody debris in the channel throughout its length. However, sources of recruitment of new large woody debris appear to be limited. Habitat complexity is good, but the amount of sediment in the channel limits aquatic insect production in riffle areas. This area is relatively low gradient. My conclusion is that this area is evolving into a good quality riparian area, which will stabilize the banks eventually. Occupation of the area by beavers may continue to create a problem for anadromous fish passage. Water temperatures during the summer period (data from the summer of 2003 only) indicate that this area is generally unsuitable for salmonid rearing. This situation could change with increased riparian community development and additional runoff from urban development. This area has a documented history of supporting chinook salmon spawning and rearing during the late fall and winter period.

3. 2003 Placer County Stream Videography Project: On March 12, 2003 Antelope Creek was videotaped from the air, from the confluence with Dry Creek upstream to King Road in Loomis. Review of the videotape shows a stream that has three segments that have different characteristics and anadromous fish production potential.

The first segment runs from the confluence with Dry Creek upstream to somewhere in the vicinity of Sunset Blvd. This segment has a relatively large channel, is protected by a formal greenway in downstream areas and a reasonable riparian zone in the upper portion of the segment. The downstream portion of this segment is dominated by excessive sediment loading, mostly decomposed granite, eroding banks, and long-term potential for a good riparian zone and vegetation. This segment has documented chinook salmon presence.

The second segment runs from about Sunset Blvd. upstream to about Midas Avenue. This segment has a much narrower riparian zone, the channel is much more incised, and there are numerous reaches where adjacent land uses are much more compatible than housing (e.g., golf course and community parks). The channel is much smaller than downstream and the major tributary is Clover Valley Creek. This segment and Clover Valley Creek have documented chinook salmon spawning and Clover Valley Creek has documented presence of "trout".

The third segment runs from about Midas Avenue upstream to the Sierra College/King Road area in Loomis. In this segment the stream narrows from about 8-10 ft wide in the downstream end of the segment to about 4-5 ft. wide at King Road. In the middle of this segment, near the railroad bridge crossing in Rocklin just downstream of Del Mar Avenue, there is a large wetlands complex and dam that changes the nature of the stream dramatically. In the area downstream of this wetlands complex, there may be some potential for anadromous fish production, but the size of the stream and the general character of the channel limit the potential. Members of the Myers family who reside about ¼ mile upstream of Midas Avenue indicate that they occasionally have seen a salmon in the backyard reach of the stream (Dana Myers, personal communication). Sediment in this area appears to be from soil and not the heavy layers of decomposed granite.

E. Fishery Resource Data

1. Documented Fish Species Present in the Stream

California Department of Fish and Game, Region 2 files. Region 2 files contain documentation of varying types that indicate that the following species have been found in Antelope Creek at various times:

Fall-run chinook salmon (native)	Brown bullhead
"trout"	Black bullhead
Golden shiner	"bass"
Green sunfish	Mosquitofish
Carp	Hitch
Speckled dace	Sacramento sucker
Sacramento pikeminnow (formerly known as Sacramento squawfish)	

2. Fish Stocking Records. No records of fish stocking were found in Department of Fish and Game files.

3. Adult Spawning Timing, Distribution, and Population Estimates (Antelope and Clover Valley Creeks)

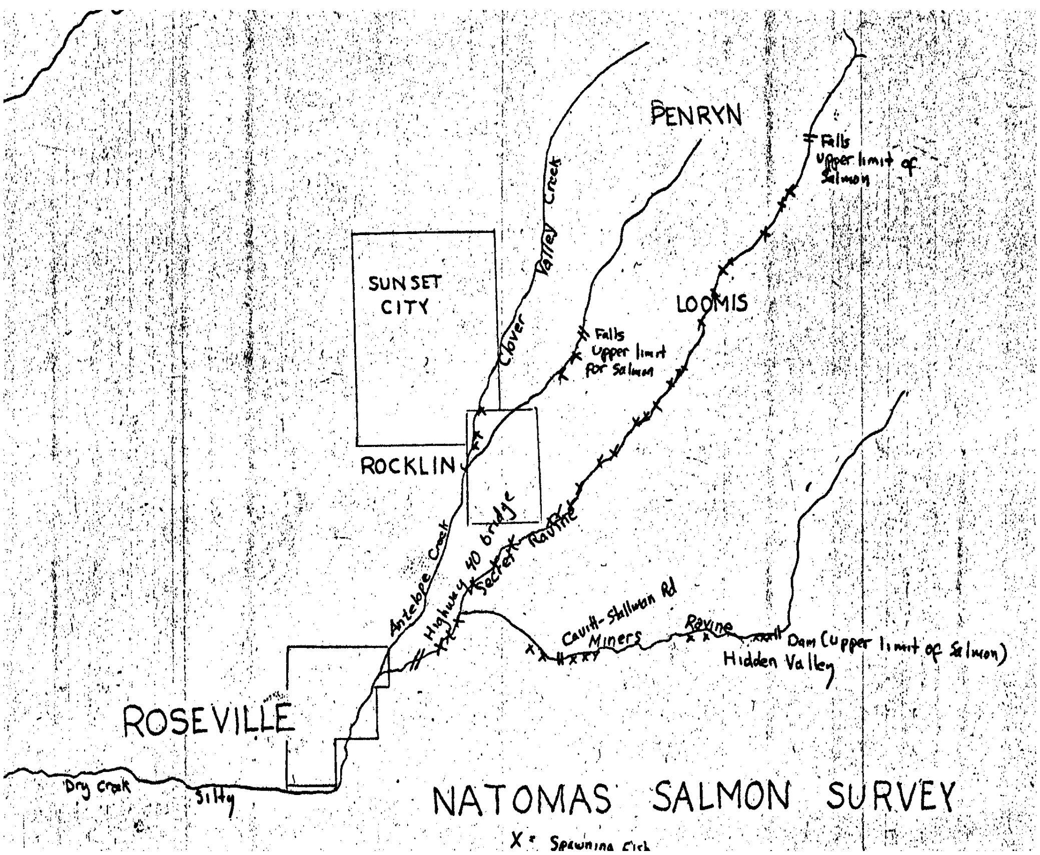
- **April 3, 1964 Letter:** This letter, regarding construction activities within the Sunset City boundaries (Figure 7), concludes that fall-run chinook enter and spawn within the boundaries [of Sunset City] in both Antelope Creek and Clover Valley Creek. **Source: 4/3/64 Department of Fish and Game letter regarding construction in Sunset City; California Department of Fish and Game, Region 2 files.**

- **1963 Fall-Run Chinook Spawning Survey by Eric Gerstung:** This letter, discussing a proposed Clover Valley reservoir project, describes the results of the fall-run chinook salmon spawning survey conducted in 1963. The letter indicates that a survey was conducted on 12/3/63 from the Sunset City [Whitney Oaks?] Golf Course to the upper culvert [no location specified] (See also Figure 7 below). Although, this letter concludes that chinook use the lower ½ mile of stream (Clover Valley Creek), Gerstung concluded from redd counts that 10 pair of fish spawned in the fall of 1963. Fry from this year's spawning were observed [presumably in the immediate area] on 4/12/1964. **Source: 10/19/64 Department of Fish and Game letter regarding a proposed Clover Valley reservoir project located about 1 mile upstream of the confluence with Antelope Creek; California Department of Fish and Game, Region 2 files.**

- **1964 Fall-Run Chinook Spawning Survey by Eric Gerstung:** Gerstung conducted a survey of 1,000 ft. of stream (noted in the records as "Clover Valley" and "Sunset" in the original memo) on 11/23/64. Based on Figure 7 and the section surveyed being described in the memorandum as "Sunset," I have concluded that the survey actually occurred in

Clover Valley Creek. This conclusion conflicts with a 5/9/2002 CDFG letter (discussed below) but is consistent with a 10/19/64 CDFG letter regarding salmon surveys in 1963 (immediately above). Gerstung saw 1 carcass and 1 live fish. He estimated the run size to be 10 fish and indicated that the run size was similar to 1963, although no specific reference to any particular stream was noted. Water clarity was reported as clear and flow estimated at 5 cfs. **Source: May 25, 1965 memorandum in CDFG, Region 2 files.**

Figure 7. Location of 1964 salmon spawning surveys conducted by Eric Gerstung. This figure shows that he found fish spawning in Clover Valley Creek and Antelope Creek.

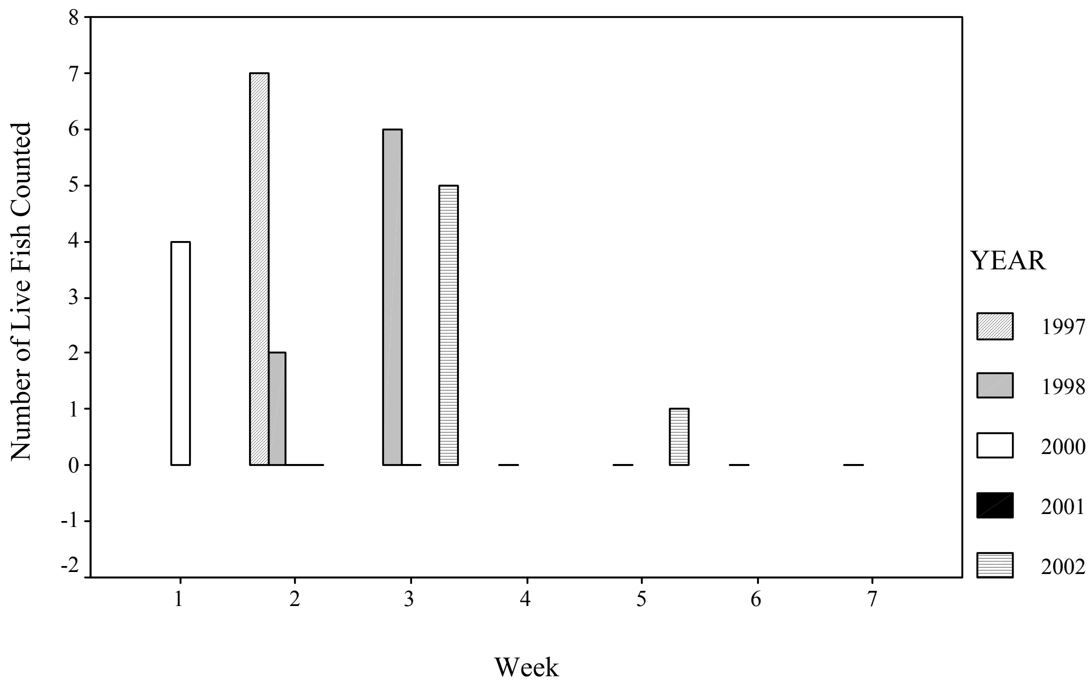


- **December 6, 1985 Spawning Survey:** Antelope Creek was surveyed for fall-run chinook salmon on 12/6/85. The stream was surveyed from the confluence with Dry Creek to approximately1 mile upstream. No live fish were seen, but one skeleton was observed. Visibility was rated poor (6"), flow estimated at 10 cfs, and no gravel was noted. **Source: 12/19/85 Memorandum from CDFG Biologist Phil Hanson, CDFG, Region 2 files.**

- **5/9/2002 Letter Regarding the Proposed Clover Valley Development:** This letter discusses anadromous salmonids [fall-run chinook salmon?] and the proposed housing development in Clover Valley. This letter states that Department files show anadromous salmonids downstream of the proposed development. The letter also states that adult chinook carcasses were found downstream of Sunset-Whitney Golf Course on 12/3/64. This conclusion is different from the actual survey data and conclusions reached in two contemporary letters signed by the Department in 1964. I conclude that this letter misinterpreted the data from the earlier sources and that fall-run chinook salmon have been documented spawning in the lower ½ mile of Clover Valley Creek. **Source: 5/9/2002 Letter in CDFG Region 2, files.**

- **Summary of Dry Creek Conservancy Fall-run Chinook Salmon Surveys in Antelope Creek:** Dry Creek Conservancy members have been conducting foot surveys during the fall and early winter since 1997. The reach surveyed is described as being from Atlantic Street in Roseville upstream to the culverts at the old dump, which is a distance of about 3,000 ft. Surveys usually begin about November 1st and continue until late December. Surveys are not systematic or comprehensive and do not include all known spawning areas. **Source: Dry Creek Conservancy; unpublished data.**

Figure 8. Summary of fall-run chinook sampling surveys, with number of live fish reported, from 1997 to 2002 in a 3,000 ft. section of Antelope Creek in Roseville.



4. Juvenile Distribution and Sampling Data

- **10/19/1964 Letter:** This letter regarding a proposed reservoir project in Clover Valley documents two sets of observations regarding fish species composition in Clover Valley Creek. The first indicates that the stream has been perennial since 1909 when water releases from PG&E started and the local game warden reports "trout" in the upper portion of the stream.

The second observation documents results of an electrofishing survey conducted in two locations (lower section within Sunset City below a small diversion dam and an upper section above the Sunset City diversion) on 8/4/64. Catch at the lower section is reported as "small suckers" with flow estimated a 1.5 cfs. No distance electrofished is reported. At the upper section, catch is reported as: carp, suckers, mosquitofish, squawfish, and hitch. Flow was estimated as 4 cfs, water temperature 72 F, stream width 10 ft., and the stream bottom silty with patches of gravel. **Source: 10/19/64 Department of Fish and Game letter regarding a proposed Clover Valley reservoir project located about 1 mile upstream of the confluence with Antelope Creek; California Department of Fish and Game, Region 2 files.**

- **Spring 1965 Fall-Run Chinook Juvenile Emigration Survey by Eric Gerstung:** Gerstung began trapping for downstream migrant fall-run chinook juveniles in Antelope Creek (no location noted) on February 17, 1965 and continued through February 24th when the trap was moved to Auburn Ravine. Sampling was with a "riffle" trap or perforated plate trap. The trap fished a total of 166 ½ hours and captured no juvenile chinook salmon. Catch composition is noted as 2 crayfish, 1 carp, and 2 squawfish. Water temperatures were reported as ranging from 46-48 F during this week. **Source: May 25, 1965 memorandum in CDFG, Region 2 files; handwritten draft of May 25, 1965 memo, and other handwritten notes.**

- **March 1972 One-Time Electrofishing Event:** The Department of Fish and Game conducted a one-time electrofishing event on March 30, 1972 at a location described as a 100 yard section northeast of the railroad bridge [this could be one of two places, either in Roseville or in Rocklin downstream of Del Mar Avenue] in Antelope Creek. Based on the catch composition I conclude that this site is at the Roseville location. Catch composition is reported as: 5- golden shiners, 2- hitch, 9- squawfish, 2 – dace, 3- black bullhead, 1- brown bullhead, 2-yearling bass not captured but observed, and 4-green sunfish. Flow was reported as high. **Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.**

F. Fish Passage or Screening Data

1. Man Made Structures and Natural Barriers

Two man-made structures are of concern. The first is the asphalt-bottomed culvert under Sunset Blvd. in Rocklin. This culvert is no doubt a barrier under low, and possibly moderate, flow conditions. The second is the dam immediately upstream of the railroad bridge in Rocklin. This dam creates a large wetlands complex and may or may not be a barrier to adult anadromous salmonids moving upstream. In Figure 7, Eric Gerstung notes a waterfall on Antelope Creek as being a barrier to upstream salmon migration. That assessment is nearly 40 years old and may no longer be valid. There are no records in CDFG files to indicate that the barrier has been removed and review of the recent videotapes did not reveal the presence of a falls, although it would have been possible to miss such a small feature. These two situations warrant further evaluation.

2. Water Flows

Low flows in Antelope Creek or Clover Valley Creek could eliminate or impede adult anadromous fish passage during critical times of the year. However, since flow volumes are mainly determined by rainfall amounts and not importation or extraction of large volumes by water agencies or diverters, natural flows will continue to be the controlling factor. Also, it is possible that as the watershed continues to urbanize, less water will infiltrate into the groundwater, thus lowering the water table and/or reducing minimum summer and early fall flows. Increasing the area of impermeable surface will also result in increased and more rapidly rising peak runoff and instream flow followed by more rapid declines in flow following the peak. This quick peaking and decline in flows tends to alter the natural hydrodynamics of a stream channel and can lead to bank erosion and increased sediment transport and deposition in and to downstream areas. Given that natural flows are the dominate flow factor in this watershed, there are changes in channel geometry that can be made, using acceptable stream restoration techniques, that will result in pool scour, increasing water depth in the thalweg, and improved sediment transport. All of these habitat features are in short supply in this watershed

3. Beaver Dams

Beaver dams in Antelope Creek are a continuing impediment to adult anadromous fish attempting to move into upstream areas to spawn. For example, a large impassable beaver dam remained in place for the entire winter of 2002-03 just upstream of the bridge at Antelope Creek Drive in Roseville (Bailey Environmental, unpublished data). Evidence of other dams downstream from this location were also present, but these dams did partially wash out during a high flow event. Beaver dam management must be considered an option in order to make upstream spawning and rearing areas available for anadromous fish in this watershed.

APPENDIX ANTELOPE CREEK 1

SELECTED WATER QUALITY DATA
FROM THE ANTELOPE CREEK WATERSHED

LOCATION	DATE	NO3	PO4	PH	ALK	HARD
Near Sierra College Blvd	12/12/00	---	---	8.16	---	---
Near Sierra College Blvd	01/17/01	---	---	7.98	78.00	92.00
Near Sierra College Blvd	02/13/01	---	---	8.30	62.00	68.00
Near Sierra College Blvd	03/08/01	---	---	8.02	70.00	64.00
Near Sierra College Blvd	04/10/01	---	---	7.50	68.00	80.00
Near Sierra College Blvd	06/01/01	---	---	7.36	54.00	48.00
Near Sierra College Blvd	06/26/01	---	---	7.46	54.00	48.00
Near Sierra College Blvd	07/11/01	---	---	7.44	24.00	28.00
Near Sierra College Blvd	08/23/01	---	---	7.51	26.00	24.00
Near Sierra College Blvd	09/28/01	---	---	7.10	38.00	32.00
Near Sierra College Blvd	10/17/01	---	---	6.84	46.00	72.00
Near Sierra College Blvd	11/13/01	.43	---	---	---	---
Near Sierra College Blvd	11/26/01	---	---	6.70	70.00	56.00
Near Sierra College Blvd	12/21/01	---	---	---	---	---
Near Sierra College Blvd	02/08/02	---	---	7.10	---	---
Near Sierra College Blvd	03/09/02	---	---	7.60	---	---
Near Sierra College Blvd	06/15/02	.09	.37	8.01	---	---
Near Sierra College Blvd	10/14/02	.07	.11	7.67	---	---
Near Sierra College Blvd	04/08/03	.00	.25	7.72	---	---
Sunset Blvd.	12/12/00	---	---	7.66	---	---
Sunset Blvd.	01/17/01	---	---	7.68	70.00	92.00
Sunset Blvd.	02/13/01	---	---	8.29	62.00	68.00
Sunset Blvd.	03/08/01	---	---	8.01	72.00	68.00
Sunset Blvd.	04/10/01	---	---	8.09	70.00	68.00
Sunset Blvd.	06/01/01	---	---	8.02	56.00	56.00
Sunset Blvd.	06/26/01	---	---	7.53	56.00	56.00
Sunset Blvd.	07/11/01	---	---	8.65	44.00	68.00
Sunset Blvd.	08/23/01	---	---	7.85	36.00	36.00
Sunset Blvd.	09/28/01	---	---	7.35	36.00	24.00
Sunset Blvd.	10/17/01	---	---	6.78	56.00	60.00
Sunset Blvd.	11/26/01	---	---	6.80	68.00	64.00
Sunset Blvd.	12/21/01	---	---	---	---	---
Sunset Blvd.	02/08/02	---	---	6.50	---	---
Atlantic Ave.	11/13/01	.75	---	---	---	---
Atlantic Ave.	03/16/02	---	---	7.70	---	---
Atlantic Ave.	06/22/02	.07	.61	7.56	---	---
Atlantic Ave.	10/05/02	.15	.22	7.67	---	---
Atlantic Ave.	11/08/02	.98	.75	7.08	---	---
Atlantic Ave.	04/04/03	.26	.19	7.77	---	---
Clover Valley Ck.	11/13/01	---	---	---	---	---
Clover Valley Ck.	03/09/02	---	---	7.70	---	---
Clover Valley Ck.	06/15/02	---	---	7.50	---	---
Clover Valley Ck.	10/15/02	.09	.12	7.27	---	---
Clover Valley Ck.	04/08/03	.03	.14	7.55	---	---

APPENDIX ANTELOPE CREEK 2

BENTHIC MACROINVERTEBRATE DATA
COLLECTED BY THE DRY CREEK CONSERVANCY

Antelope Creek Benthic Macroinvertebrate Samples 2000

	TV	FFG	51	52	53	Total
			Antelope Creek			
SAMPLING STATION:			2000			
REPLICATE #	TV	FFG	51	52	53	Total
PHYLUM ARTHROPODA						
Class Insecta						
Coleoptera (Larvae)						
Elmidae	4	c				
Dubiraphia sp.	6	c				
Microcylloepus sp.	4	c				
Diptera						
Ceratopogonidae	6	p				
Bezzia sp./ Palpomyia sp.	6	p			1	1
Dasyhelea sp. (pupa)	6	nf				
Chironomidae	6					
Chironominae						
Chironomini	6	c				
Pseudochironomini	5	c				
Tanytarsini	6	c	12	8	8	28
Orthocladiinae	5	c	18	4	19	41
Tanypodinae	7	p				
Empididae	6	p				
Clinocera sp.	6	p				
Hemerodromia sp.	6	p				
Neoplasta sp.	6	p				
Muscidae	6	p				
Limnophora sp.	6	p				
Simuliidae	6	f				
Simulium sp.	6	f	12	49	16	77
Tipulidae	3					
Limonia sp.	6	s				
Hemiptera						
Corixidae	8	p				
Sigara sp.	8	p				
Megaloptera						
Sialidae	4	p				
Sialis sp.	4	p				
Odonata						
Calopterygidae	5	p				
Hetaerina sp.	6	p				

	Coenagrionidae			p				
		Argia sp.	7	p	5	1	4	10
	Gomphidae		4	p				
		Ophiogomphus occidentis.	4	p	1			1
	Libellulidae		9	p				
		Brechmorhoga mendax	9	p	4		2	6
Lepidoptera								
	Nepticulidae			s				
	Pyralidae		5					
		Petrophila sp.	5	g	1		3	4
Ephemeroptera								
	Baetidae		4	g				
		Baetis sp.	5	c	15	20	21	56
		Camelobaetidius sp.	4	c				
		Fallceon quilleri	4	c			2	2
	Caenidae		7	c				
		Caenis sp.	7	c			1	1
	Ephemerellidae		1	c				
		Eurylophella lodi	1	c				
	Leptohyphidae		4	c				
		Tricorythodes minutus	4	c	14	3	3	20
Plecoptera								
	Chloroperlidae		1	p				
	Perlodidae		2	p				
		Isoperla sp.	2	p				
Trichoptera								
	Glossosomatidae		0	g				
		Protoptila coloma	1	g	6		1	7
	Helicopsychidae		3	g				
		Helicopsyche borealis	3	g				
	Hydropsychidae		4	f				
		Hydropsyche californica	4	f	54	123	103	280
	Hydroptilidae		4	g				
		Hydroptila sp.	6	g				
		Leucotrichia pictipes	6	g			5	5
		Ochrotrichia sp.	4	c				
		Oxyethira sp.	3	c				
	Lepidostomatidae		1	s				
		Lepidostoma sp.	1	s				
	Leptoceridae		4	c				
		Mystacides alafimbriata	4	c				
		Nectopsyche gracilis	3	c				

Triaenodes/Ylodes sp.	6	s				
Philopotamidae	3	f				
Chimarra sp.	4	f				
Wormaldia sp.	3	f				
Subphylum Chelicerata						
Class Arachnoidea						
Acari						
Hygrobatidae	8	p				
Hygrobates sp.	8	p				
Megapella sp.	8	p				
Lebertiidae	8	p				
Lebertia sp.	8	p			1	1
Sperchontidae	8	p				
Sperchon sp.	8	p	9	2	9	20
Torrenticolidae	5	p				
Torrenticola sp.	5	p				
Subphylum Crustacea						
Class Malacostraca						
Amphipoda						
Cragonyctidae	4	c				
Crangonyx sp.	4	c			2	2
Stygobromus sp.	4	c				
Hyalellidae	8	c				
Hyalella sp.	8	c				
Decapoda						
Astacidae	8	c				
Pacifasticus lenisculus	6	c			1	1
Class Ostracoda						
Ostracoda	8	c				
Cyprididae	8	c			2	2
PHYLUM COELENTERATA						
Class Hydrozoa						
Hydroida						
Hyridae						
Hydra sp.	5	p				
PHYLUM MOLLUSCA						
Class Gastropoda						
Pulmonata						
Ancylidae	6	g				
Ferrissia sp.	6	g	2	2	5	9
Lymnaeidae	6	g				
Fossaria sp.	8	g				

Physidae	8	g				
Physa sp./ Physella sp.	8	g			1	1
Planorbidae	6	g				
Gyraulus sp.	8	g				
Helisoma sp.	6	g			1	1
Micromenetus sp.	6	g				
Class Bivalvia						
Pelecypoda	8	f				
Corbiculidae	10	f				
Corbicula fluminea	10	f	30	10	12	52
Sphaeriidae	8	f				
Pisidium sp.	8	f				
PHYLUM NEMATODA	5	p		1	3	4
PHYLUM PLATYHELMINTHES						
Class Turbellaria						
Tricladida						
Planariidae	4	p				
Dugesia tigrina	4	p	94	24	2	120
PHYLUM ANNELIDA						
Class Oligochaeta	5	c	34	18	40	92
Megadrili	5	c				
PHYLUM NEMERTEA						
Class Enopla						
Tertastemmatidae						
Prostoma graecense	8	p	30	10	23	63
Total			341	275	291	907
Taxa Richness			17	14	27	28
Percent Dominant Taxon			28	45	35	31
EPT Taxa			4	3	7	7
EPT Index (%)			26.1	53.1	46.7	40.9
Sensitive EPT Index			1.8	0.0	0.3	0.8
Ephemeroptera Taxa			2.0	2.0	4.0	4.0
Plecoptera Taxa			0.0	0.0	0.0	0.0
Trichoptera Taxa			2.0	1.0	3.0	3.0
Dipteran Taxa			3.0	3.0	4.0	4.0
Percent Dipteran			12.3	22.2	15.1	16.2
Non-Insect Taxa			6.0	7.0	13.0	13.0
Percent Non-Insect			58.4	24.4	35.1	40.6
Percent Chironomidae			8.8	4.4	9.3	7.6
Percent Hydropsychidae			15.8	44.7	35.4	30.9
Percent Baetidae			4.4	7.3	7.9	6.4

Shannon Diversity			2.3	1.8	2.4	2.3
Tolerance Value			5.4	5.0	5.4	5.3
Percent Intolerant (0-2)			1.8	0.0	0.3	0.8
Percent Tolerant (8-10)			21.4	8.0	17.2	16.0
Percent Collectors			27.3	19.3	34.0	27.0
Percent Filterers			28.2	66.2	45.0	45.1
Percent Grazers			2.6	0.7	5.5	3.0
Percent Predators			41.9	13.8	15.5	24.9
Percent Shredders			0.0	0.0	0.0	0.0
Total Percentages			100.0	100.0	100.0	100.0
Total Abundance			1169	1100	1164	

Antelope Creek Benthic Macroinvertebrate CSBP Summary Metrics, 2000

	Antelope Creek		
	2000		
	Mean	CV	Total
Taxa Richness	19.3	35.2	28.0
Percent Dominant Taxon	35.9	23.9	30.9
EPT Taxa	4.7	44.6	7.0
EPT Index (%)	42.0	33.6	40.9
Sensitive EPT Index	0.7	133.0	0.8
Ephemeroptera Taxa	2.7	43.3	4.0
Plecoptera Taxa	0.0	#DIV/0!	0.0
Trichoptera Taxa	2.0	50.0	3.0
Dipteran Taxa	3.3	17.3	4.0
Percent Dipteran	16.5	30.7	16.2
Non-Insect Taxa	8.7	43.7	13.0
Percent Non-Insect	39.3	44.3	40.6
Percent Chironomidae	7.5	36.2	7.6
Percent Hydropsychidae	32.0	46.1	30.9
Percent Baetidae	6.5	28.6	6.4
Shannon Diversity	2.2	13.8	2.3
Tolerance Value	5.2	4.3	5.3
Percent Intolerant (0-2)	0.7	133.0	0.8
Percent Tolerant (8-10)	15.5	44.1	16.0
Percent Collectors	26.9	27.5	27.0

Percent Filterers	46.5	41.0	45.1
Percent Grazers	3.0	81.3	3.0
Percent Predators	23.7	66.5	24.9
Percent Shredders	0.0	#DIV/0!	0.0

Antelope Creek Benthic Macroinvertebrate Samples 2001

			Antelope Creek @ Atlantic				Antelope Creek @ King Rd.			
SAMPLING STATION:			2001				2001			
REPLICATE #	TV	FFG	79	80	81	Total	85	86	87	Total
PHYLUM ARTHROPODA										
Class Insecta										
Coleoptera (Larvae)										
Elmidae	4	c								
Dubiraphia sp.	6	c								
Microcylloepus sp.	4	c								
Diptera										
Ceratopogonidae	6	p								
Bezzia sp./ Palpomyia sp.	6	p								
Dasyhelea sp. (pupa)	6	nf								
Chironomidae	6									
Chironominae										
Chironomini	6	c								
Pseudochironomini	5	c								
Tanytarsini	6	c	93	63	85	241	11	2		13
Orthocladiinae	5	c	8	6	10	24	12	2	8	22
Tanypodinae	7	p								
Empididae	6	p								
Clinocera sp.	6	p								
Hemerodromia sp.	6	p		2		2				
Neoplasta sp.	6	p								
Muscidae	6	p								
Limnophora sp.	6	p								
Simuliidae	6	f								
Simulium sp.	6	f	18	24	11	53	9	27	117	153
Tipulidae	3									
Limonia sp.	6	s								
Hemiptera										
Corixidae	8	p								
Sigara sp.	8	p								
Megaloptera										

	Sialidae		4	p								
		Sialis sp.	4	p								
Odonata												
	Calopterygidae		5	p								
		Hetaerina sp.	6	p								
	Coenagrionidae			p								
		Argia sp.	7	p	7	3	5	15	2		6	8
	Gomphidae		4	p								
		Ophiogomphus occidentis.	4	p						1		1
	Libellulidae		9	p								
		Brechmorhoga mendax	9	p	1	1	1	3			1	1
Lepidoptera												
	Nepticulidae			s					2			2
	Pyralidae		5									
		Petrophila sp.	5	g	6	13	6	25				
Ephemeroptera												
	Baetidae		4	g								
		Baetis sp.	5	c	31	25	36	92		2		2
		Camelobaetidius sp.	4	c								
		Fallceon quilleri	4	c			1	1				
	Caenidae		7	c								
		Caenis sp.	7	c	1			1	3			3
	Ephemerellidae		1	c								
		Eurylophella lodi	1	c					2			2
	Leptohyphidae		4	c								
		Tricorythodes minutus	4	c	4	6	12	22	14		4	18
Plecoptera												
	Chloroperlidae		1	p								
	Perlodidae		2	p								
		Isoperla sp.	2	p								
Trichoptera												
	Glossosomatidae		0	g								
		Protoptila coloma	1	g		1		1				
	Helicopsychidae		3	g								
		Helicopsyche borealis	3	g								
	Hydropsychidae		4	f								
		Hydropsyche californica	4	f	44	42	49	135	23	1	1	25
	Hydroptilidae		4	g								
		Hydroptila sp.	6	g	1		1	2				
		Leucotrichia pictipes	6	g	7	12	5	24				
		Ochrotrichia sp.	4	c								

Oxyethira sp.	3	c	1			1				
Lepidostomatidae	1	s								
Lepidostoma sp.	1	s								
Leptoceridae	4	c								
Mystacides alafimbriata	4	c					4			4
Nectopsyche gracilis	3	c								
Triaenodes/Ylodes sp.	6	s								
Philopotamidae	3	f								
Chimarra sp.	4	f								
Wormaldia sp.	3	f								
Subphylum Chelicerata										
Class Arachnoidea										
Acari										
Hygrobatidae	8	p								
Hygrobates sp.	8	p								
Megapella sp.	8	p								
Lebertiidae	8	p								
Lebertia sp.	8	p								
Sperchontidae	8	p								
Sperchon sp.	8	p	5	5	3	13	1	2	2	5
Torrenticolidae	5	p								
Torrenticola sp.	5	p								
Subphylum Crustacea										
Class Malacostraca										
Amphipoda										
Cragonyctidae	4	c								
Crangonyx sp.	4	c					150	1	3	154
Stygobromus sp.	4	c								
Hyalellidae	8	c								
Hyalella sp.	8	c					1			1
Decapoda										
Astacidae	8	c								
Pacifasticus lenisculus	6	c					1			1
Class Ostracoda										
Ostracoda	8	c								
Cyprididae	8	c							1	1
PHYLUM COELENTERATA										
Class Hydrozoa										
Hydroida										
Hyridae										
Hydra sp.	5	p								
PHYLUM MOLLUSCA										

Class Gastropoda										
Pulmonata										
Ancylidae	6	g								
Ferrissia sp.	6	g		1		1	1	1		2
Lymnaeidae	6	g								
Fossaria sp.	8	g						1		1
Physidae	8	g								
Physa sp./ Physella sp.	8	g					5			5
Planorbidae	6	g								
Gyraulus sp.	8	g								
Helisoma sp.	6	g	1			1				
Micromenetus sp.	6	g								
Class Bivalvia										
Pelecypoda	8	f								
Corbiculidae	10	f								
Corbicula fluminea	10	f	6	6	4	16	22	55	29	106
Sphaeriidae	8	f								
Pisidium sp.	8	f								
PHYLUM NEMATODA	5	p	4	2	3	9	5	8	18	31
PHYLUM PLATYHELMINTHES										
Class Turbellaria										
Tricladida										
Planariidae	4	p								
Dugesia tigrina	4	p	35	35	24	94	8	1	2	11
PHYLUM ANNELIDA										
Class Oligochaeta	5	c	37	18	28	83	9	30	50	89
Megadrili	5	c								
PHYLUM NEMERTEA										
Class Enopla										
Tertastemmatidae										
Prostoma graecense	8	p	18	19	27	64	37	14	59	110
Total			328	284	311	923	322	148	301	771
Taxa Richness			20	19	18	24	21	15	14	26
Percent Dominant Taxon			28	22	27	26	47	37	39	20
EPT Taxa			7	5	6	9	5	2	2	6
EPT Index (%)			27.1	30.3	33.4	30.2	14.3	2.0	1.7	7.0
Sensitive EPT Index			0.3	0.4	0.0	0.2	0.6	0.0	0.0	0.3
Ephemeroptera Taxa			3.0	2.0	3.0	4.0	3.0	1.0	1.0	4.0
Plecoptera Taxa			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trichoptera Taxa			4.0	3.0	3.0	5.0	2.0	1.0	1.0	2.0
Dipteran Taxa			3.0	4.0	3.0	4.0	3.0	3.0	2.0	3.0
Percent Dipteran			36.3	33.5	34.1	34.7	9.9	20.9	41.5	24.4

Non-Insect Taxa			7.0	7.0	6.0	8.0	11.0	9.0	8.0	13.0
Percent Non-Insect			32.3	30.3	28.6	30.4	74.5	76.4	54.5	67.1
Percent Chironomidae			30.8	24.3	30.5	28.7	7.1	2.7	2.7	4.5
Percent Hydropsychidae			13.4	14.8	15.8	14.6	7.1	0.7	0.3	3.2
Percent Baetidae			9.5	8.8	11.9	10.1	0.0	1.4	0.0	0.3
Shannon Diversity			2.3	2.4	2.3	2.4	2.0	1.8	1.8	2.3
Tolerance Value			5.5	5.4	5.5	5.5	5.2	7.4	6.5	6.1
Percent Intolerant (0-2)			0.0	0.4	0.0	0.1	0.6	0.0	0.0	0.3
Percent Tolerant (8-10)			9.1	10.9	11.3	10.4	20.5	48.6	30.6	29.8
Percent Collectors			53.4	41.5	55.3	50.4	64.3	25.0	21.9	40.2
Percent Filterers			20.7	25.4	20.6	22.1	16.8	56.1	48.8	36.8
Percent Grazers			4.6	9.5	3.9	5.9	1.9	1.4	0.0	1.0
Percent Predators			21.3	23.6	20.3	21.7	16.5	17.6	29.2	21.7
Percent Shredders			0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.3
Total Percentages			100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Total Abundance			2624	1704	2496		322	148	301	

Antelope Creek Benthic Macroinvertebrate CSBP Summary Metrics, 2001

	Antelope Creek @ Atlantic			Antelope Creek @ King Rd.		
	2001			2001		
	Mean	CV	Total	Mean	CV	Total
Taxa Richness	19.0	5.3	24.0	16.7	22.7	26.0
Percent Dominant Taxon	26.0	12.7	26.1	40.9	12.3	20.0
EPT Taxa	6.0	16.7	9.0	3.0	57.7	6.0
EPT Index (%)	30.3	10.4	30.2	6.0	119.9	7.0
Sensitive EPT Index	0.2	87.3	0.2	0.2	173.2	0.3
Ephemeroptera Taxa	2.7	21.7	4.0	1.7	69.3	4.0
Plecoptera Taxa	0.0	#DIV/0!	0.0	0.0	#DIV/0!	0.0
Trichoptera Taxa	3.3	17.3	5.0	1.3	43.3	2.0
Dipteran Taxa	3.3	17.3	4.0	2.7	21.7	3.0
Percent Dipteran	34.6	4.3	34.7	24.1	66.4	24.4
Non-Insect Taxa	6.7	8.7	8.0	9.3	16.4	13.0
Percent Non-Insect	30.4	6.1	30.4	68.5	17.7	67.1
Percent Chironomidae	28.5	12.9	28.7	4.2	61.8	4.5
Percent Hydropsychidae	14.7	8.0	14.6	2.7	141.2	3.2
Percent Baetidae	10.1	16.2	10.1	0.5	173.2	0.3
Shannon Diversity	2.3	3.0	2.4	1.9	7.4	2.3
Tolerance Value	5.5	0.2	5.5	6.4	17.4	6.1
Percent Intolerant (0-2)	0.1	173.2	0.1	0.2	173.2	0.3
Percent Tolerant (8-10)	10.4	10.8	10.4	33.2	42.9	29.8

Percent Collectors	50.1	14.9	50.4	37.1	63.7	40.2
Percent Filterers	22.2	12.2	22.1	40.6	51.6	36.8
Percent Grazers	6.0	51.4	5.9	1.1	89.8	1.0
Percent Predators	21.7	7.8	21.7	21.1	33.6	21.7
Percent Shredders	0.0	#DIV/0!	0.0	0.2	173.2	0.3

Clover Valley Creek Benthic Macroinvertebrate Samples 2001

			Clover Valley Crk @ Park				Clover Valley Creek At Taglio			
SAMPLING STATION:			2001				2001			
REPLICATE #	TV	FFG	76	77	78	Total	82	83	84	Total
PHYLUM ARTHROPODA										
Class Insecta										
Coleoptera (Larvae)										
Elmidae	4	c								
Dubiraphia sp.	6	c								
Microcylloepus sp.	4	c								
Diptera										
Ceratopogonidae	6	p								
Bezzia sp./ Palpomyia sp.	6	p								
Dasyhelea sp. (pupa)	6	nf							1	1
Chironomidae	6									
Chironominae										
Chironomini	6	c	2	1		3			1	1
Pseudochironomini	5	c								
Tanytarsini	6	c	14	23	19	56	9	2	41	52
Orthocladiinae	5	c	50	44	18	112		1	22	23
Tanypodinae	7	p						1	8	9
Empididae	6	p								
Clinocera sp.	6	p								
Hemerodromia sp.	6	p					1		3	4
Neoplasta sp.	6	p								
Muscidae	6	p								
Limnophora sp.	6	p								
Simuliidae	6	f								
Simulium sp.	6	f	7	3	8	18	2	2	11	15
Tipulidae	3									
Limonia sp.	6	s								
Hemiptera										
Corixidae	8	p								
Sigara sp.	8	p							1	1
Megaloptera										
Sialidae	4	p								
Sialis sp.	4	p	1			1				
Odonata										
Calopterygidae	5	p								
Hetaerina sp.	6	p						2	7	9
Coenagrionidae		p								
Argia sp.	7	p	2		1	3	2	2	8	12

Order	Family	Taxon	TV	FFG								
	Gomphidae		4	p								
		Ophiogomphus occidentis.	4	p					1	1		2
	Libellulidae		9	p								
		Brechmorhoga mendax	9	p								
Lepidoptera												
	Nepticulidae			s								
	Pyralidae		5									
		Petrophila sp.	5	g								
Ephemeroptera												
	Baetidae		4	g								
		Baetis sp.	5	c	7			7		1	8	9
		Camelobaetidius sp.	4	c								
		Fallceon quilleri	4	c								
	Caenidae		7	c								
		Caenis sp.	7	c	7	14		21				
	Ephemerellidae		1	c								
		Eurylophella lodi	1	c			1	1				
	Leptohyphidae		4	c								
		Tricorythodes minutus	4	c					3	1	3	7
Plecoptera												
	Chloroperlidae		1	p								
	Perlodidae		2	p								
		Isoperla sp.	2	p								
Trichoptera												
	Glossosomatidae		0	g								
		Protoptila coloma	1	g								
	Helicopsychidae		3	g								
		Helicopsyche borealis	3	g								
	Hydropsychidae		4	f								
		Hydropsyche californica	4	f	11	15	5	31	52	8	22	82
	Hydroptilidae		4	g								
		Hydroptila sp.	6	g								
		Leucotrichia pictipes	6	g								
		Ochrotrichia sp.	4	c								
		Oxyethira sp.	3	c			1	1				
	Lepidostomatidae		1	s								
		Lepidostoma sp.	1	s						2		2
	Leptoceridae		4	c								
		Mystacides alafimbriata	4	c								
		Nectopsyche gracilis	3	c								
		Triaenodes/Ylodes sp.	6	s							2	2

Philopotamidae	3	f								
Chimarra sp.	4	f								
Wormaldia sp.	3	f								
Subphylum Chelicerata										
Class Arachnoidea										
Acari										
Hygrobatidae	8	p								
Hygrobates sp.	8	p								
Megapella sp.	8	p								
Lebertiidae	8	p								
Lebertia sp.	8	p		1		1			1	1
Sperchontidae	8	p								
Sperchon sp.	8	p	3		2	5	3		2	5
Torrenticolidae	5	p								
Torrenticola sp.	5	p								
Subphylum Crustacea										
Class Malacostraca										
Amphipoda										
Cragonyctidae	4	c								
Crangonyx sp.	4	c					13	57	73	143
Stygobromus sp.	4	c								
Hyalellidae	8	c								
Hyalella sp.	8	c								
Decapoda										
Astacidae	8	c								
Pacifasticus lenisculus	6	c			1	1				
Class Ostracoda										
Ostracoda	8	c								
Cyprididae	8	c								
PHYLUM COELENTERATA										
Class Hydrozoa										
Hydroida										
Hyridae										
Hydra sp.	5	p								
PHYLUM MOLLUSCA										
Class Gastropoda										
Pulmonata										
Ancylidae	6	g								
Ferrissia sp.	6	g	31	21	16	68		3		3
Lymnaeidae	6	g								
Fossaria sp.	8	g						1		1
Physidae	8	g								

Physa sp./ Physella sp.	8	g			4	4	1	15	1	17
Planorbidae	6	g								
Gyraulus sp.	8	g								
Helisoma sp.	6	g								
Micromenetus sp.	6	g	1			1		1		1
Class Bivalvia										
Pelecypoda	8	f								
Corbiculidae	10	f								
Corbicula fluminea	10	f	1	71	42	114	23	9	5	37
Sphaeriidae	8	f								
Pisidium sp.	8	f	1		1	2		5		5
PHYLUM NEMATODA	5	p	25	6	1	32	13	1		14
PHYLUM PLATYHELMINTHES										
Class Turbellaria										
Tricladida										
Planariidae	4	p								
Dugesia tigrina	4	p	1		1	2		1	15	16
PHYLUM ANNELIDA										
Class Oligochaeta	5	c	73	43	76	192	11	13	60	84
Megadrili	5	c					14	3		17
PHYLUM NEMERTEA										
Class Enopla										
Tertastemmatidae										
Prostoma graecense	8	p	16	53	16	85	17	11	2	30
Total			253	295	213	761	165	143	297	605
Taxa Richness			18	12	17	23	15	23	22	30
Percent Dominant Taxon			29	24	36	25	32	40	25	24
EPT Taxa			3	2	3	5	2	4	4	5
EPT Index (%)			9.9	9.8	3.3	8.0	33.3	8.4	11.8	16.9
Sensitive EPT Index			0.0	0.0	0.9	0.3	0.0	1.4	0.0	0.3
Ephemeroptera Taxa			2.0	1.0	1.0	3.0	1.0	2.0	2.0	2.0
Plecoptera Taxa			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trichoptera Taxa			1.0	1.0	2.0	2.0	1.0	2.0	2.0	3.0
Dipteran Taxa			4.0	4.0	3.0	4.0	3.0	4.0	7.0	7.0
Percent Dipteran			28.9	24.1	21.1	24.8	7.3	4.2	29.3	17.4
Non-Insect Taxa			9.0	6.0	10.0	12.0	8.0	12.0	8.0	14.0
Percent Non-Insect			60.1	66.1	75.1	66.6	57.6	83.9	53.5	61.8
Percent Chironomidae			26.1	23.1	17.4	22.5	5.5	2.8	24.2	14.0
Percent Hydropsychidae			4.3	5.1	2.3	4.1	31.5	5.6	7.4	13.6
Percent Baetidae			2.8	0.0	0.0	0.9	0.0	0.7	2.7	1.5
Shannon Diversity			2.2	2.1	2.0	2.2	2.2	2.2	2.3	2.6

Tolerance Value			5.5	7.0	6.5	6.3	5.8	5.6	5.1	5.4
Percent Intolerant (0-2)			0.0	0.0	0.5	0.1	0.0	1.4	0.0	0.3
Percent Tolerant (8-10)			8.3	42.4	30.5	27.7	26.7	28.7	4.0	16.0
Percent Collectors			60.5	42.4	54.5	51.8	30.3	54.5	70.0	55.5
Percent Filterers			7.9	30.2	26.3	21.7	46.7	16.8	12.8	23.0
Percent Grazers			12.6	7.1	9.4	9.6	0.6	14.0	0.3	3.6
Percent Predators			19.0	20.3	9.9	17.0	22.4	13.3	15.8	17.0
Percent Shredders			0.0	0.0	0.0	0.0	0.0	1.4	0.7	0.7
Total Percentages			100.0	100.0	100.0	100.0	100.0	100.0	99.7	99.8
Total Abundance			253	295	213		165	143	297	

Clover Valley Creek Benthic Macroinvertebrate CSBP Summary Metrics, 2001						
	Clover Valley Crk @ Park			Clover Valley Creek At Taglio		
	2001			2001		
	Mean	CV	Total	Mean	CV	Total
Taxa Richness	15.7	20.5	23.0	20.0	21.8	30.0
Percent Dominant Taxon	29.5	19.8	25.2	32.0	23.9	23.6
EPT Taxa	2.7	21.7	5.0	3.3	34.6	5.0
EPT Index (%)	7.7	49.5	8.0	17.8	75.8	16.9
Sensitive EPT Index	0.3	173.2	0.3	0.5	173.2	0.3
Ephemeroptera Taxa	1.3	43.3	3.0	1.7	34.6	2.0
Plecoptera Taxa	0.0	#DIV/0!	0.0	0.0	#DIV/0!	0.0
Trichoptera Taxa	1.3	43.3	2.0	1.7	34.6	3.0
Dipteran Taxa	3.7	15.7	4.0	4.7	44.6	7.0
Percent Dipteran	24.7	15.8	24.8	13.6	100.7	17.4
Non-Insect Taxa	8.3	25.0	12.0	9.3	24.7	14.0
Percent Non-Insect	67.1	11.3	66.6	65.0	25.4	61.8
Percent Chironomidae	22.2	20.0	22.5	10.8	107.9	14.0
Percent Hydropsychidae	3.9	36.1	4.1	14.8	97.5	13.6
Percent Baetidae	0.9	173.2	0.9	1.1	123.6	1.5
Shannon Diversity	2.1	4.0	2.2	2.2	3.8	2.6
Tolerance Value	6.3	11.8	6.3	5.5	6.1	5.4
Percent Intolerant (0-2)	0.2	173.2	0.1	0.5	173.2	0.3
Percent Tolerant (8-10)	27.1	63.9	27.7	19.8	69.1	16.0
Percent Collectors	52.4	17.6	51.8	51.6	38.8	55.5
Percent Filterers	21.5	55.4	21.7	25.4	72.8	23.0
Percent Grazers	9.7	28.6	9.6	5.0	156.8	3.6
Percent Predators	16.4	34.8	17.0	17.2	27.5	17.0
Percent Shredders	0.0	#DIV/0!	0.0	0.7	101.3	0.7

AUBURN RAVINE

A. Water Quality Data

1. Lincoln High School Water Quality Monitoring: Mark Fowler and Lee Beckman provided data from the Lincoln High School sampling program, which is jointly funded by NID, Placer County, and the City of Lincoln. While the data are limited, two parameters are of concern from a stream ecology standpoint. First, the dissolved oxygen concentrations reported show supersaturated levels of approximately 150%, which is unusual for lower gradient streams. Second, the concentrations of nitrate reported for Highway 193 and Joiner Parkway sites are high for a fall reading and could indicate eutrophication of the stream, particularly during the summer months. Without data on orthophospate for comparison, it is not possible to determine if nitrates are limiting biostimulation of algal growth and potentially causing diurnal dissolved oxygen fluctuations during the nighttime hours. **Source: Lincoln High School Sampling Program, unpublished data.**

Table 1. Auburn Ravine Water Quality Data 2001-2

Parameter	Mackenroth Property	Highway 193 Bridge	Joiner Parkway Bridge
Date	9/21/2002	10/7/2002	9/23/2001
Time	1000	1128	1045
Air Temperature (^{O}F)	67	--	--
Water Temperature (^{O}F)	60	65	62
Weather	Clear	Clear	Clear
Stream Flow (cfs)	7.7	1.5	1.5
pH	7.7	7.7	7.16
Dissolved Oxygen (mg/l)	13.4	13.4	16.5
Electrical Conductivity (µs/cm)	152.9	56.4	71.7
Color (color units)	42	1	8.5
Nitrates (mg/l)	0.7	1.1	1.90
Chlorides (mg/l)	0.04	0.07	0.02
Total Coliform (MPN/100ml)	240	290	290
Fecal Coliform (MPN/100ml)	460	93	75

2. Auburn Ravine/Coon Creek Ecosystem Restoration Plan: This plan, published by the County of Placer, contains preliminary data on heavy metals and a number of other constituents. The data were collected on Auburn Ravine, Coon Creek, and in the Eastside Canal (the actual sampling location is actually just upstream of the Cross Canal, even though the data location is labeled Cross Canal). The County is already in possession of these data in electronic format and the data are not re-presented, except for data on cadmium, copper, and zinc, which are presented in Appendix Auburn Ravine 1 because all of these metals at some times of the year exceed California Toxic Rule objectives for aquatic life. In Auburn Ravine, the only metal that exceeds the standards at 50 mg/l hardness is copper. The other metals are included because their standards are exceeded in other streams in the western portion of the County. Based on these data, the ratio between orthophosphate and a combination of dissolved nitrite and nitrate appears to be reasonable and should not cause excessive algal blooms at this downstream location. **Source: California Toxics Rule and Department of Water Resources unpublished data.**

3. 1992 City of Auburn Wastewater Treatment and Disposal Master Plan DEIR: Table 3-2 in DEIR displays summary data from three stations. These stations are Clark Ranch at Bridge Lane (upstream of Fowler Road), Brewer Road crossing, and Catlett Road crossing in Sutter County. Four or five samples (Bridge Lane only) were taken during August-September of 1987, with no specific dates given. Table 2 displays the pertinent average summary data. In general, the water quality parameters measured fall within an expected and acceptable range for anadromous fish streams. Appendix E in the DEIR includes a complete set of data for the U.S. EPA priority pollutant scan required for NPDES permit renewal. Review of this data did not indicate any problems with pesticide concentrations, and the heavy metals analysis shows no readings that exceed California Toxic Rule standards. **Source: 1992 City of Auburn Wastewater Treatment and Disposal Master Plan DEIR; R.E. Beck. 1987. "A Preliminary Report on Fishery Viability of Auburn Ravine Creek, Placer County, California", from Department of Fish and Game files, Region 2.**

Table 2. Mean values of selected water quality constituents from three locations along Auburn Ravine from samples collected during Aug.-Sep. 1987.

Constituent	Clark Ranch Bridge Lane	Brewer Road Crossing	Catlett Road Crossing
Number of samples	5	4	4
Turbidity	None	V. Slight	Milky
Temperature	64	67	68
pH	7.0	7.3	7.3
Ammonia Nitrogen	0.6 mg/l	0.4 mg/l	0.8 mg/l
Dissolved Oxygen	10 mg/l	10 mg/l	6 mg/l
Carbon Dioxide	5 mg/l	5 mg/l	26 mg/l
Total Acidity	9 mg/l	10 mg/l	36 mg/l
Total Alkalinity	23 mg/l	65 mg/l	150 mg/l
Hardness	34 mg/l	77 mg/l	155 mg/l

Source: 1992 City of Auburn Wastewater Treatment and Disposal Master Plan DEIR; R.E. Beck. 1987. "A Preliminary Report on Fishery Viability of Auburn Ravine Creek, Placer County, California", from Department of Fish and Game files, Region 2.

4. 1997 City of Auburn FEIR Auburn Wastewater Facility Plan: This FEIR contains data on a variety of water quality parameters measured on Auburn Ravine sources. These measurements include a U.S. EPA priority pollutant scan for pesticides and heavy metals. Data on heavy metals concentrations are presented in Table 3-10 of the FEIR. These data show no metals at concentrations of concern for the protection of aquatic life in Auburn Ravine upstream of the discharge. No data is presented for areas immediately downstream of the discharge location. Table 3-11 in the FEIR also shows some water quality data for six stations downstream of Lincoln (Table 3-11 in the FEIR indicates that station L7 is upstream of the City of Lincoln, but Figure 1 in Appendix E of the FEIR shows station L7 downstream of the City. The data in Table 3-11 do show one area of concern, the range of pH values over the sampling period at the "lower reach" of 5.95-7.4. The low value of 5.95 is of concern because of its potential effects on aquatic life. Also of concern is the range of values recorded over a relatively short "summer" time period. Appendix Auburn Ravine 2 of this report is adapted from Table 3-9 in the FEIR and displays sampling results during 1995 at two locations, one upstream of the discharge location (R-1) and one immediately downstream of the discharge in the mixing zone (R-4). These data show pH values fluctuating from 5.7 to 7.4 over the course of two months. This pattern is consistent with that observed in other nearby watersheds. Appendix B of this report also shows that water temperatures and dissolved oxygen levels are suitable for spawning and rearing of anadromous fish species on a year around basis. **Source**: **1997 City of Auburn FEIR Auburn Wastewater Facility Plan.**

5. 1996 City of Auburn, Draft Auburn Wastewater Treatment Plant Stream Study: At public request, this study was conducted to assess the impacts of treatment plant expansion on the aquatic ecosystem of Auburn Ravine. This report contains much more detail on the water quality information summarized in the 1997 City of Auburn FEIR Auburn Wastewater Facility Plan mentioned directly above. **Source: 1996 City of Auburn, Draft Auburn Wastewater Treatment Plant Stream Study.**

6. 1999 DEIR City of Lincoln Wastewater Treatment and Reclamation Facility: This DEIR was prepared to support a new wastewater treatment and reclamation facility to meet growing demand within the City of Lincoln and possibly serve as a future site for a regional wastewater treatment facility which could receive effluent from Placer County's SMD #1 Plant on Joeger Road and currently a major dry weather supplier of flow to Dry/Coon Creek, the City of Auburn's Wastewater Treatment Plant located on Auburn Ravine just downstream of the City of Auburn, and effluent from Newcastle and development projects like the Bickford Ranch Project. Appendix C of this DEIR contains a variety of water quality information associated with sample taken from Auburn Ravine in 1995 and includes a U.S. EPA priority pollutant scan. These data show no identified problems with pesticides, although some metals (e.g., copper) are near or exceed California Toxics Rule standards for some samples. Appendix A in the DEIR displays the results of the Department of Water Resources sampling during 2001 near Catlett Road in Sutter County. Copper concentration exceeded California Toxic Rule standards on three occasions during the year. Copper concentrations are a concern, but exceed the standards only occasionally and appear to be of natural origin. It is likely that the local organisms have adapted to these chronic levels over time. . **Source: 1999 DEIR City of Lincoln Wastewater Treatment and Reclamation Facility.**

7. 11/3/1984 Biological Survey by David Vanicek, Sacramento State University, at the Otto Residence, just upstream of Ophir: This was a fish sampling survey, but Vanicek did report a pH of 7.3; dissolved oxygen concentration was 9.0 mg/l; and a conductivity of 195 umhos/cm. **Source: Vanicek report in Department of Fish and Game files, Region 2.**

B. <u>Water Temperature Data</u>

Water temperature data were extracted from various one-time fish sampling projects conducted by the CDFG and are presented below. Most of the data comes from monitoring conducted by Bailey Environmental and includes hourly readings. Due to limitations in the statistical package, only 3,000 temperature data points can be displayed in a single time series plot. Since daily maximum, minimum, and/or mean temperatures individually are of little value, all data points have been plotted for three time periods that correspond to:

Fall-early winter: September though December; primary fall-run chinook salmon spawning period is November-December.
Winter-spring: January though April; fall-run chinook salmon incubation and rearing and steelhead spawning, incubation, and rearing.
Late spring-summer: May to September; summer rearing for steelhead juveniles.

Data plots for these time periods are presented below to allow the reader to assess the potential of Auburn Ravine to support chinook salmon and/or steelhead trout spawning and rearing. A variety of localized data and literature was reviewed, to provide a generalized understanding of the temperature effects on various life history stages for both chinook salmon and steelhead trout. There is fairly substantial variation in temperature effects noted for most life history stages. However, both chinook salmon and steelhead have a highly adaptable physiology and ability to seek thermal refuge during part of the day, which allows them to tolerate and/or avoid lethal temperatures. Some of the literature sources cite criteria from others and some of the data is based on fish captures with water temperature taken concurrently. Two tables with data and reference are included in Appendix B of this report. Based on this review, the following criteria have been used to indicate what life history stages a particular stream may support at any given time:

Chinook Salmon	**^{O}C**	**Steelhead Trout**	**^{O}C**
Egg and fry development	14.4 (58 ^{O}F)	Egg and fry development	14.4 (58 ^{O}F)
Juvenile rearing	21.1 (70 ^{O}F)	Juvenile rearing	22.2 (72 ^{O}F)
Adult migration	21.7 (71 ^{O}F)	Adult migration and holding	22.2 (72 ^{O}F)

Reference lines for 14.4 ^{O}C and 22.2 ^{O}C have been provided on Figures 1 through 11, below to approximately represent the water temperatures suitable for salmonid spawning migration, egg and fry development, and juvenile rearing.

1. 3/3/59 One-time Electrofishing Survey Near Goldhill Road Crossing: This survey reported a water temperature of 54.5 ^{O}F and air temperature of 74 ^{O}F at 1500 hours on this date. Stream flow was estimated at 10 cfs. **Source: Unidentified author memorandum in CDFG, Region 2 files.**

2. 8/27/71 One-time Electrofishing Survey: Water temperature was reported as 68 ^{O}F on this date with no time or location given, but the author did state that there was commercial land use adjacent to the site. I speculate that this site was within the City of Lincoln. Source: **Unidentified author memorandum in CDFG, Region 2 files.**

3. 11/3/1984 Biological Survey by David Vanicek, Sacramento State University, at the Otto Residence, just upstream of Ophir: This was a fish sampling survey, but Vanicek did report a water temperature of 14 ^{O}C (57 ^{O}F) at an estimated flow of 15 cfs, with no time of measurement given. **Source: Vanicek report in Department of Fish and Game files, Region 2.**

4. 1984 seining and electrofishing for native brood year 1983 fall-run chinook salmon.

Date	Time	Water Temp. (^{O}F)	Location
2/28/84	--	52	Fowler Road
2/28/84	1100	52	Moore Road
5/2/84	--	52	Fowler Road

Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.

5. Moore Road Juvenile Trapping Survey May 9-17, 1992: This data is from a short-term juvenile chinook salmon trapping program on Auburn Ravine. The trapping location was located approximately ½ mile upstream of the Dowd Road extension on the Moore Ranch. I speculate that this site was very near the Moore Road crossing. **Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.**

Juvenile Trapping Survey May 9-17, 1992.

Date	Time	Water Temp. (^{O}F)	Location
5/10/92	1015	60	100 yards downstream of Dowd Rd.
5/11/92	0620	59	100 yards downstream of Dowd Rd.
5/12/92	0700	58	100 yards downstream of Dowd Rd.
5/13/92	0800	59	100 yards downstream of Dowd Rd.
5/14/92	1900	58	100 yards downstream of Dowd Rd.
5/15/92	0700	58	100 yards downstream of Dowd Rd.
5/16/92	0715	58	100 yards downstream of Dowd Rd.

Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.

6. 1995 Monitoring Results from the1996 City of Auburn, Draft Auburn Wastewater Treatment Plant Stream Study: Water temperature data from this study is presented in Appendix B of this report. These data show that the mean monthly maximum water temperature at station R-1, just upstream of the discharge location did not exceed 15.9 ^{O}C during the year. This indicates that this upper portion of Auburn Ravine is suitable for anadromous fish spawning and rearing on a year around basis. Daily water temperature (and certain water quality parameters) were monitored on a 15-minute basis over the period October 4-November 3, 1995. Daily mean values are presented in Tables 6A and 6B and Figure 3 of Attachment 3 in this report. **Source: 1996 City of Auburn, Draft Auburn Wastewater Treatment Plant Stream Study.**

7. Water Temperature Information From Bailey Environmental April 1999 To August 2003: This study begun by the City of Lincoln in April 1999 to provide some baseline information for their EIR on a new wastewater treatment and reclamation facility. Stations were established at Fowler Road, the Nevada Irrigation District gaging station near Highway 65 in Lincoln, just downstream of Nelson Lane, Moore Road, just downstream of Moore Road on the Moore Ranch (identified as Bitter's Property), and on the Aitken Ranch approximately 1 mile downstream of the Moore Ranch station. Because of continued vandalism problems, the Moore Road station was discontinued in 2000. Although City support for these stations ended in 2001, Bailey Environmental has maintained the data collection since then. All of the stations have suffered some data anomalies (e.g., sensors becoming buried in the sand and recording only the temperature in the sand and not daily fluctuations or someone taking the sensor out of the water). In some instances data are missing completely because of theft or sensor failure. There are some 150,000 readings from these locations. In May 2003, Placer County contracted to add additional stations on Auburn Ravine. Stations were added at the Otto Residence near the town of Ophir in the upper watershed and at the Davis Ranch Bridge off Catlett Road in Sutter County. All of the data for all of the stations has been delivered to the County in electronic format.

For this report, I have provided the current time series for the new stations (Otto and Davis Ranch Bridge; Figures 1 and 2, respectfully) and selected one-year's (Sept. 2002 to Aug 2003) data for three stations (Fowler Road (Figures 3-5), NID gaging station (Figures 6-8), Bitter's Property (Figures 9-11) to demonstrate approximate temperature regimes at each location. **Source: Bailey Environmental, unpublished data.**

Figure 1. Water temperature time series for Auburn Ravine at the Otto property, upstream of the Lozanos Road Bridge, during the period June 5 through August 4 2003. This data indicates that this area of Auburn Ravine was suitable for juvenile salmonid rearing during the warmest summer period.

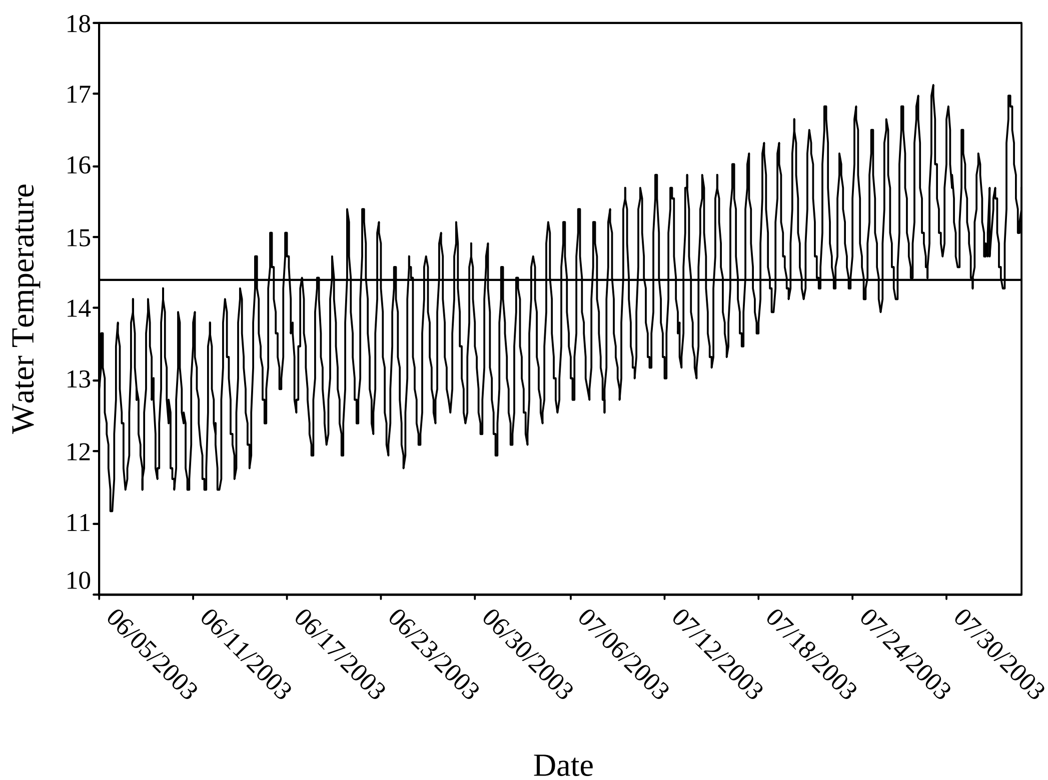


Figure 2. Water temperature time series for Auburn Ravine at the Davis Ranch Bridge in Sutter County, during the period May 28 through August 4 2003. This data indicates that this area of Auburn Ravine was unsuitable for juvenile salmonid rearing during the warmest summer period.

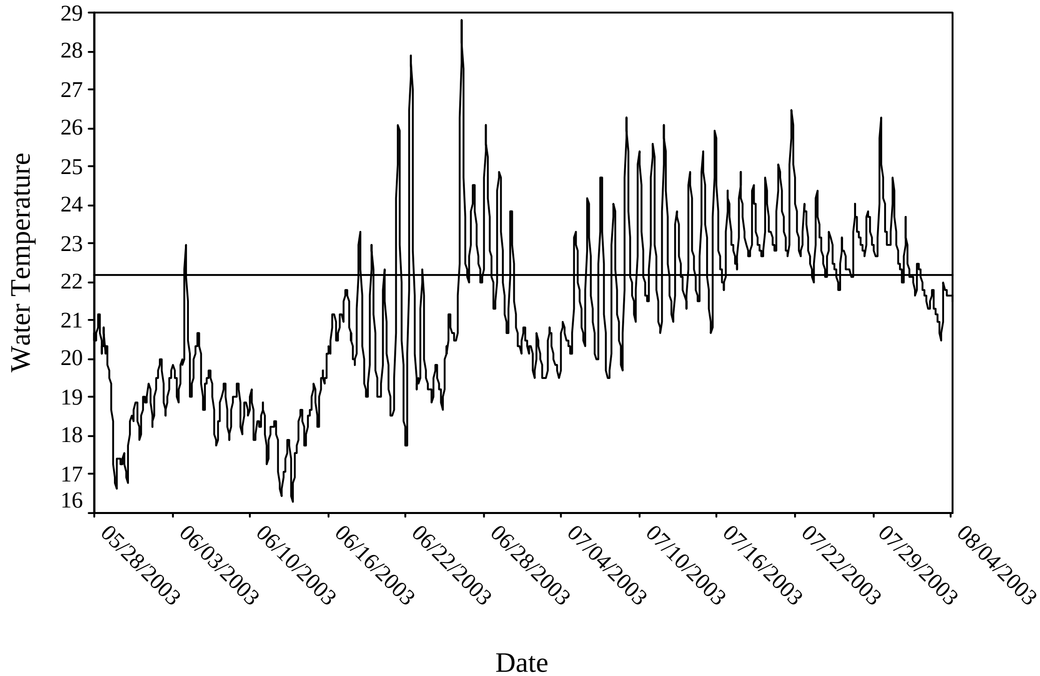


Figure 3. Water temperature time series for Auburn Ravine at the Fowler Road property, during the period September through October 22, 2002 (electronic data from October 22, 2002 to January 29, 2003 was lost). Successful fall-run chinook salmon spawning could have commenced in mid to late October and conditions were suitable for juvenile rearing.

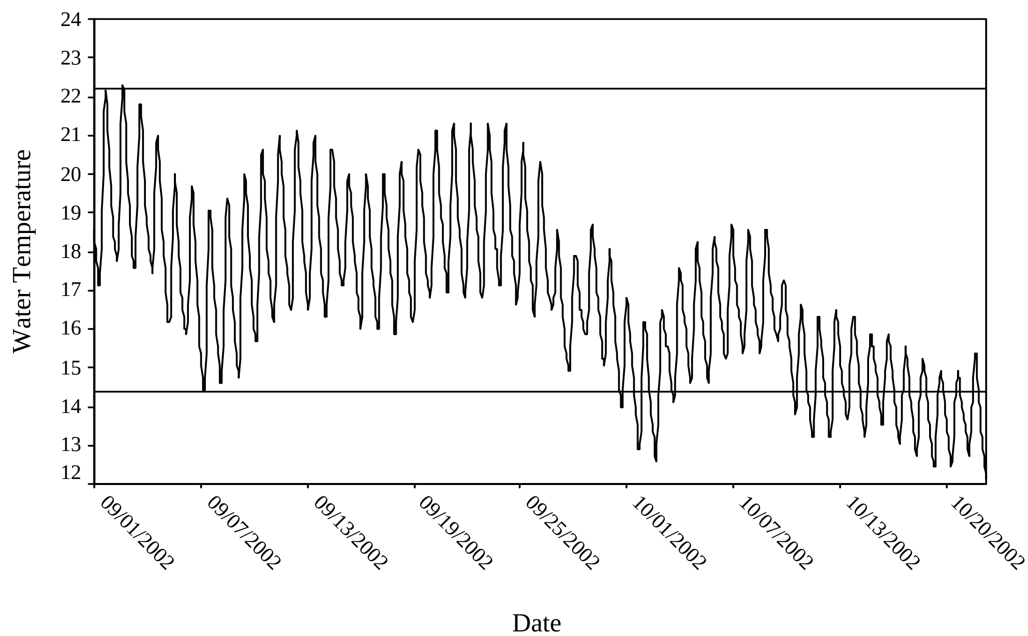


Figure 4. Water temperature time series for Auburn Ravine at the Fowler Road property, during the period January through April 2003. Temperatures are suitable for egg incubation and juvenile rearing.

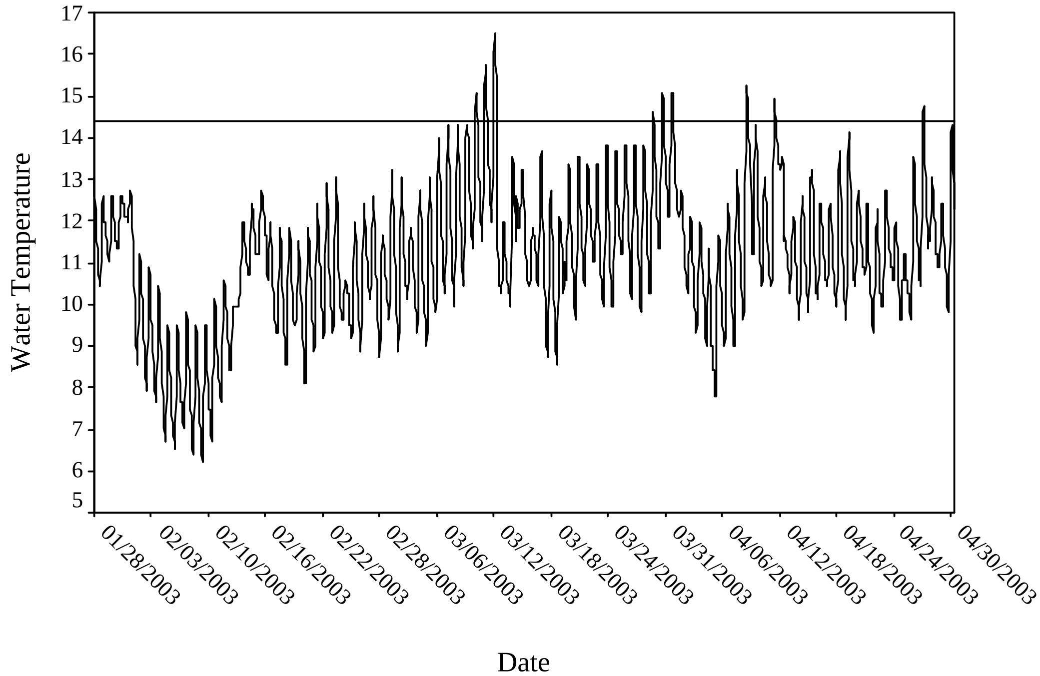


Figure 5. Water temperature time series for Auburn Ravine at the Fowler Road property, during the period May through August 4, 2003. Temperatures are suitable for juvenile rearing. Note the sensor became buried in sand during the latter portion of this time period.

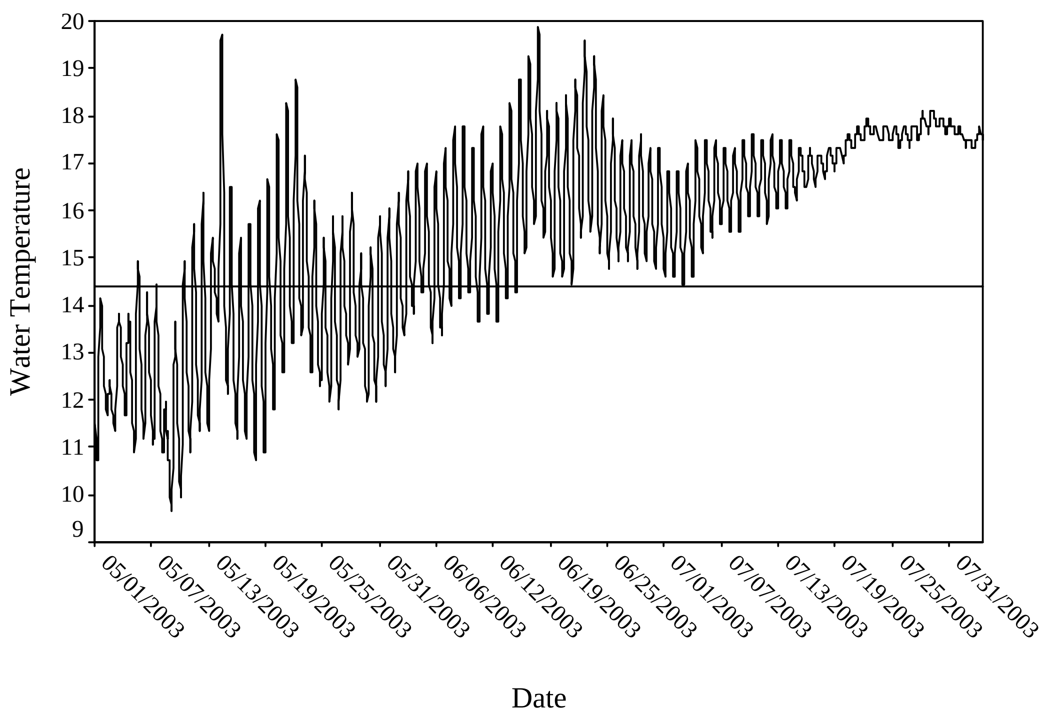


Figure 6. Water temperature time series for Auburn Ravine at the NID gaging station, during the period September 9 through December 2002. Successful fall-run chinook salmon spawning could have commenced in mid to late October. It appears that the sensor may have become buried in the substrate in mid-December.

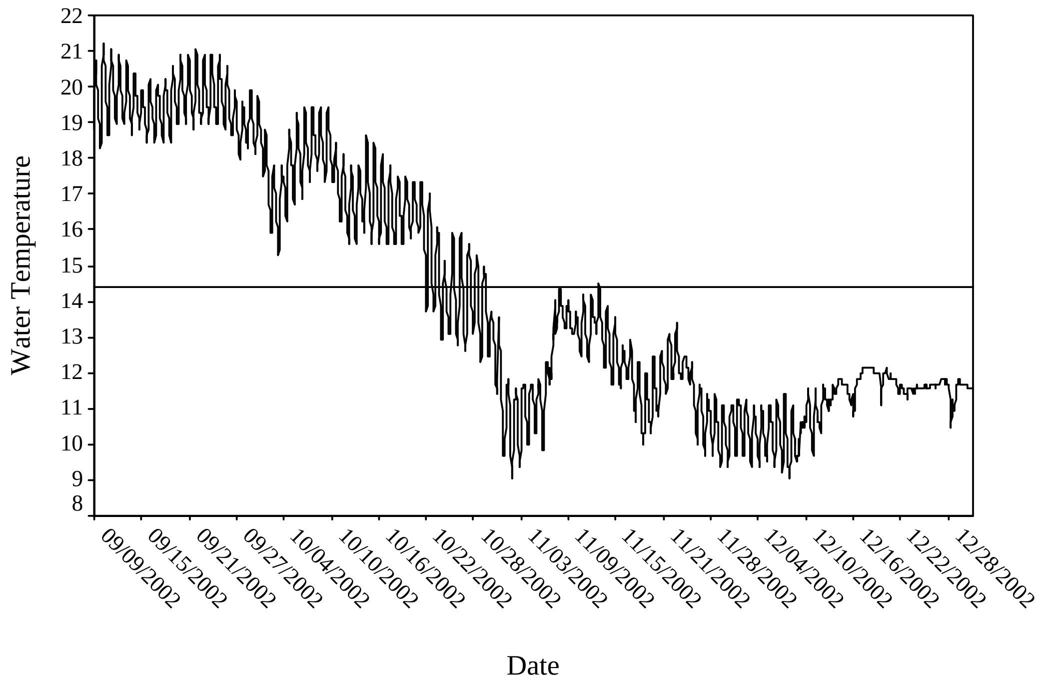


Figure 7. Water temperature time series for Auburn Ravine at the NID gaging station, during the period January through April 2003. Temperatures are suitable for egg incubation and juvenile rearing. The sensor was buried in the substrate until January 29, 2003.

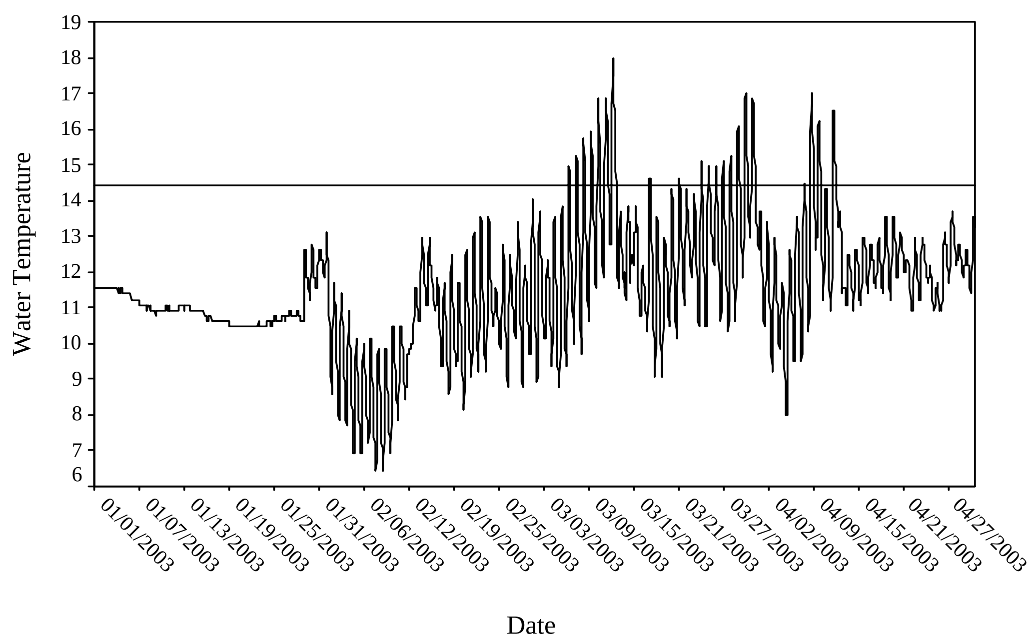


Figure 8. Water temperature time series for Auburn Ravine at the NID gaging station, during the period May through August 5 2003. Temperatures are suitable for juvenile rearing. Note the sensor became buried in sand during the latter portion of this time period.

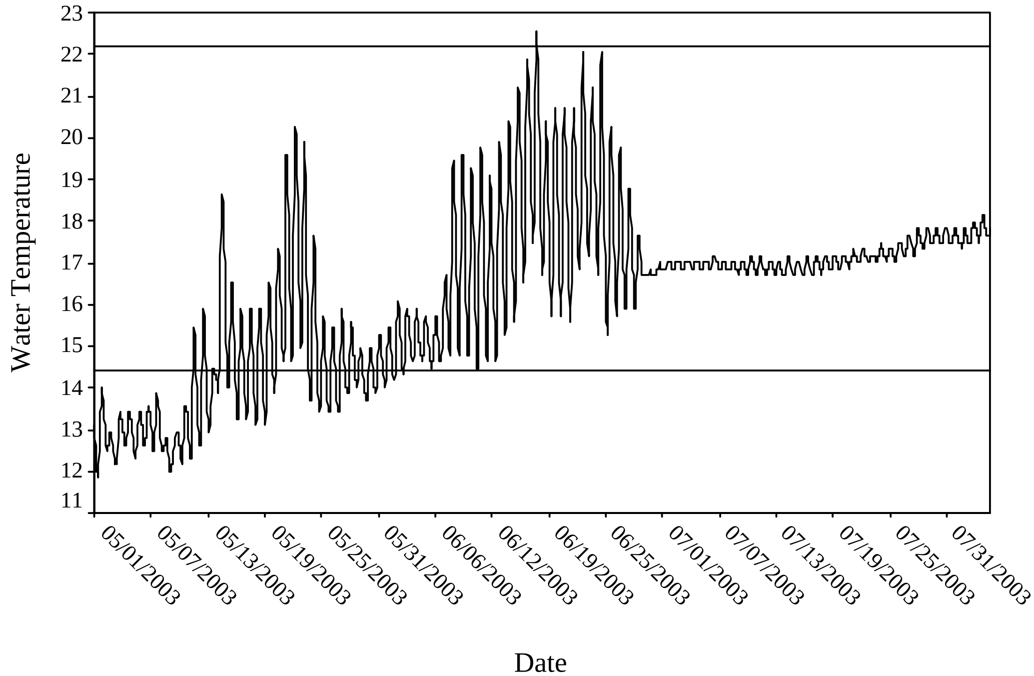


Figure 9. Water temperature time series for Auburn Ravine at the Bitters property, during the period September through October 22, 2002 (electronic data from October 22, 2002 to January 29, 2003 was lost). Successful fall-run chinook salmon spawning could have commenced in late October. However this station contains no spawning gravels and is several miles downstream of suitable spawning habitat.

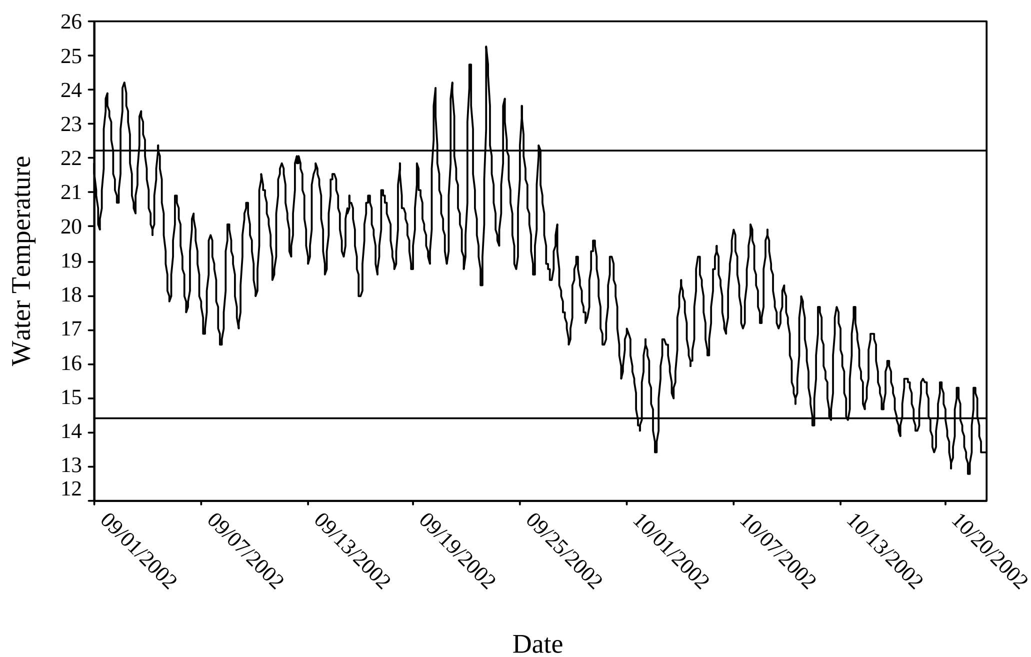


Figure 10. Water temperature time series for Auburn Ravine at the Bitter's property, during the period January 28, 2003 through April 2003. Temperatures are suitable for egg incubation and juvenile rearing.

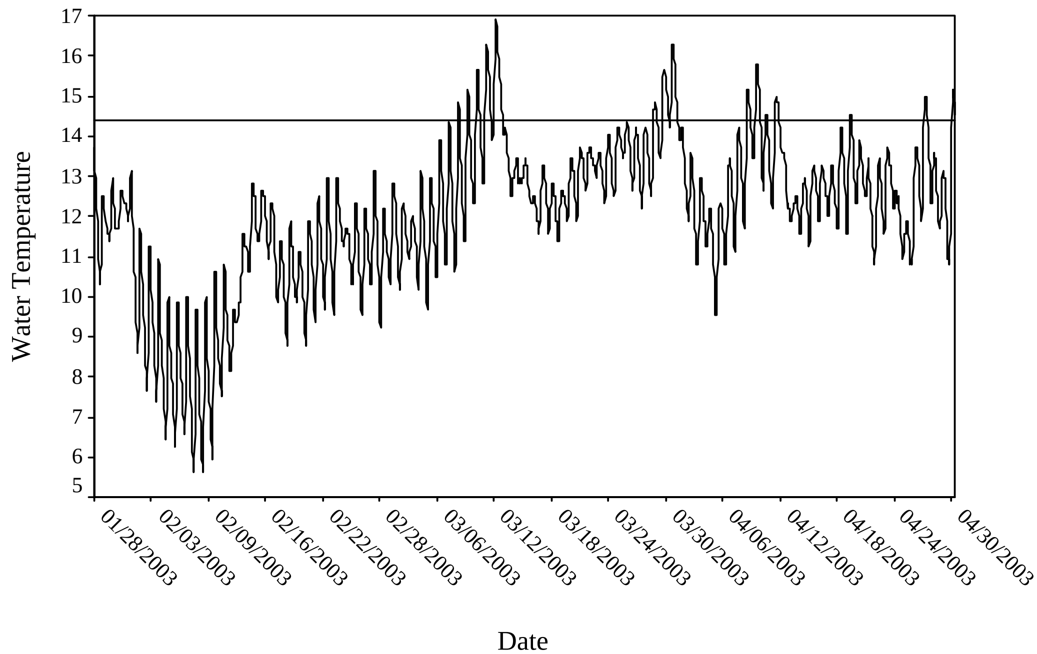
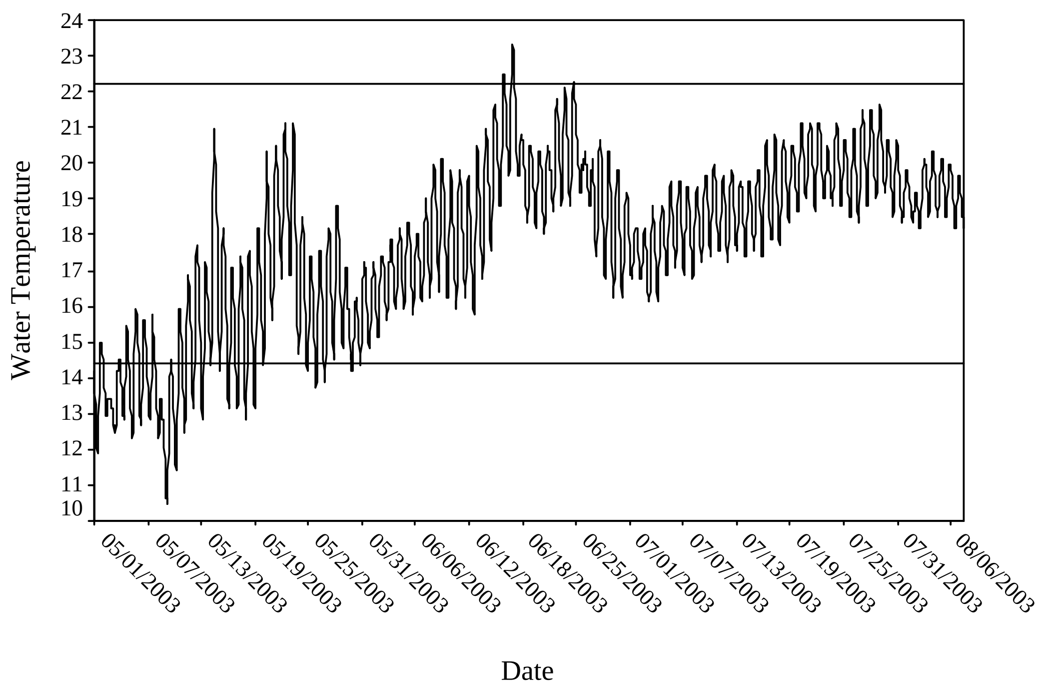


Figure 11. Water temperature time series for Auburn Ravine, Bitter's property, during the period May through August 8 2003. Temperatures are suitable for juvenile rearing.



The water temperature data from the Bailey Environmental study suggest that water temperatures are adequate to support salmonid spawning, egg incubation, and rearing in a number of locations in Auburn Ravine, although there are unsuitable conditions at Davis Ranch Bridge. The loss of some data due to apparent burying of sensors in sediment points out the problem of high sediment input to Auburn Ravine in many locations.

C. Benthic Invertebrate Data

Three separate sampling programs or projects have sampled benthic macroinvertebrates from various reaches of Auburn Ravine. These sampling efforts are described below:

1. Citizen Monitoring by the Auburn Ravine Group: Samples were collected at Moore Road and Joiner Parkway in March 200 and at Joiner Parkway in September 2001 (complete data for these three events is presented in Appendix Auburn Ravine 3). Additional samples have been collected more recently, but the analysis results will not be available until early 2004. Data from this sampling is affected by equipment limitations and sampling strategy. First, the equipment used to take the samples does not sample all of the taxa in the stream effectively. Second, taxonomic identification is limited to a maximum of 100 individuals from all taxa, but five of the 10 individual samples collected from the three sampling times and locations contain less than 55 individuals, with two samples containing less than 6 individual organisms. Such low number of individuals in a sample is highly unusual and may indicate severe pollution or habitat problems within the stream. **Source: Benthic Macroinvertebrates sampled from Placer County Streams. Prepared for the Auburn Ravine Group by BioAssessment Services, Folsom, CA., December 2002.**

2. 1997 FEIR Auburn Wastewater Facility Plan: Appendix G of this FEIR summarizes benthic macroinvertebrate sampling that occurred in the fall of 1995 and spring of 1996 in six stream reaches ranging from where Interstate 80 crosses Auburn Ravine, downstream to a reach that includes about 1500 feet of channel downstream of the Lozanos Road Bridge. Table 4 and Figures 9 and 10 in this appendix summarize the results of the fall 1995 sampling. More detailed information on all of the sampling is presented in Attachment 2 of the Draft Auburn Wastewater Treatment Plant Stream Study, August 1996. Results are somewhat mixed, but the Department of Fish and Game concluded that for at least one of the sampling periods, some impairment of benthic macroinvertebrates was noted downstream of the discharge; the FEIR did not find impairment. **Source: 1997 FEIR Auburn Wastewater Facility Plan; 1996 Draft Auburn Wastewater Treatment Plant Stream Study**

3. 1999 DEIR City of Lincoln Wastewater Treatment and Reclamation Facility: This DEIR reports the results of sampling that occurred in early November 1997 at six locations ranging from about the Highway 193 Bridge in the City of Lincoln, downstream to a location located on the Aitken Ranch near the confluence with Orchard Creek. Three samples were taken at each site. A summary of results is presented in Chapter 7 of the DEIR, with more detailed results presented in Appendix F.3. Most of these samples were taken in an area of the stream where the channel is mostly sand bottomed, although two of the sampling sites upstream of Highway 65 do show increased taxon diversity. However, the species richness and diversity are much less than what was recorded in the 1995-96 Auburn study upstream. This result would be expected because of the differences in water temperature regime, channel substrate, and level of nutrients in these downstream reaches. This study confirms the poor habitat quality for aquatic insects important to rearing juvenile salmonids. **Source: 1999 DEIR City of Lincoln Wastewater Treatment and Reclamation Facility**

D. Physical Habitat Data

1. October 16-19 1995 Physical Habitat Survey Conducted by CH2MHill for the City of Auburn: This survey was conducted as part of a stream study to document some of the conditions in Auburn Ravine to support the CEQA process for the upgrade and expansion of the City of Auburn's Wastewater Treatment Facility. A level 3 Department of Fish and Game protocol was completed on six stream reaches ranging from Interstate 80, downstream to 1,500 feet downstream from the Lozanos Road Bridge. A summary of the data and findings are presented in Table 5 of Attachment 3 of the 1996 Draft Auburn Wastewater Treatment Plant Stream Study. A listing of data parameters recorded is presented below. Photos were taken of some sections and are available from the surveyors. Bailey Environmental has copies of the original data sheets. These data indicate that this area of Auburn Ravine is dominated by riffles/cascades (50+% in each reach) and about 20% pool habitat in each reach. Estimated stream gradient in the various reaches ranges from 2.2 to 3.9%. Only cursory summary information has been developed. Detailed and/or statistical analysis is possible if needed.

Parameters Recorded	Parameters Recorded	Parameters Recorded
Date Sampled	Water Depth at Pool Tail Crest (ft)	Left Stream Bank Soil Composition
Habitat Unit Number	Dominant Substrate Size	Right Stream Bank Soil Composition
Habitat Type	Subdominant Substrate Size	Left Stream Bank Vegetation Composition
Side Channel Habitat Type	Shelter Rating	Right Stream Bank Vegetation Composition
Mean Length of Habitat Unit (ft.)	Percent Shelter Type in Habitat Unit	Percent Left Bank Vegetated
Mean Channel Width (ft.)	Percent Total Canopy	Percent Right Bank Vegetated
Mean Water Depth (ft.)	Percent Coniferous Trees	Percent Deciduous Trees
Maximum Water Depth (ft.)		

Source: 1996 Draft Auburn Wastewater Treatment Plant Stream Study; Bailey Environmental, unpublished data from CH2Mhill.

2. 1999 DEIR City of Lincoln Wastewater Treatment and Reclamation Facility: Appendix F.2 of this DEIR contains all of the information regarding a 3-day survey of Auburn Ravine beginning at the South Sutter Water District diversion on the Aitken Ranch upstream to the Joiner Parkway Bridge in the City of Lincoln. The survey included a cursory assessment of water quality, sediment size and condition, channel structure, and vegetative cover. The survey indicates that shallow runs and glides dominate the channel. The bottom substrate is primarily sand with some coarser gravel. Channel complexity was greatest in areas where riparian vegetation and tree canopy was highest. Several beaver dams, debris dams, and man-made diversion dam sites were also recorded. **Source: 1999 DEIR City of Lincoln Wastewater Treatment and Reclamation Facility**

3. 2003 Placer County Spawning Gravel Survey: During the summer of 2003, Placer County funded a survey to examine steelhead trout spawning gravels in this drainage (as well as others). No data are currently available from this effort. However, based on a review of the sampling protocol, it appears that little, if any useful additional information will be obtained.

4. 2003 Placer County Stream Videography Project: On March 12, 2003 this Auburn Ravine was videotaped from the air, beginning the Eastside Canal, upstream to the Wise Powerhouse near Auburn. Review of the video footage shows the riparian area of the stream varies from very poor quality (downstream areas) to very high quality (upstream of Fowler Road). Also, this footage revealed extensive bank erosion that is contributing to the sediment load in the stream. The proportion of the excessive sediment load attributable to bank erosion versus decomposition of underlying rock formations is unknown. Sediment contributions from land disturbing activities and roadways are also unknown. Based on the video footage and field observations over a period of more than 4 years, I consider the area of stream downstream from about the mid-point between Nelson Lane and Jointer Parkway Bridge as only a migratory corridor for anadromous fish. This area is mostly sand bottomed, low gradient channel with little potential for accommodating good quality spawning or rearing habitats for anadromous fish. The area between just downstream of the Joiner Parkway Bridge and locations upstream appears to be suitable for chinook salmon spawning and rearing, with some steelhead rearing also possible in this area. The area upstream of Fowler Road appears to be suitable spawning and rearing area for both chinook salmon and steelhead trout. This upstream area has a higher gradient, less sediment in the gravels, and high levels of desirable habitat complexity than observed in downstream areas.

E. Fishery Resource Data

1. Documented Fish Species Present in the Stream

Redear sunfish
Black bullhead
Bluegill
Largemouth bass
Green sunfish
Mosquitofish
Hardhead
Brown trout
Prickly sculpin
Pumpkinseed
Golden shiner
Lamprey sp.
California roach
Carp
Rainbow trout/steelhead
Sacramento sucker
Speckled dace
Fall chinook salmon (native)
Fall chinook salmon (introduced – Feather River Fish Hatchery)
Fall chinook salmon (introduced – Nimbus Fish Hatchery)
Spring chinook salmon (introduced – Feather River Fish Hatchery)
Sacramento pikeminnow (formerly known as Sacramento squawfish)

Source: California Department of Fish and Game, Region 2 files; 1999 DEIR City of Lincoln Wastewater Treatment and Reclamation Facility; 1996 Draft Auburn Wastewater Treatment Plant Stream Study.

2. Fish Stocking Records

The following stocking records were found in CDFG's Region 2 files:

Species	Origin	Date	Size (No./lb)	Mean Length*	Number Stocked	Location
Brown trout	Mt. Shasta	6/25/30			10,000	Dutch Ravine tributary near Goldhill Road
Brown trout	Mt. Shasta	7/1/32			10,000	Dutch Ravine tributary near Goldhill Road
Rainbow trout	Mt. Shasta or possibly Bear River	1948				Note that stream was planted, but no planting receipt
Rainbow trout	Bear River	7/28/49	232	56	4,988	Could be near Wise Powerhouse or east
Rainbow trout	Bear River	1950	245	55	1,989	USGS Quad description not in Auburn Ravine Watershed
Rainbow trout	Mt. Shasta	7/19/51	224	56	2,602	Near Wise Powerhouse
Rainbow trout	Mt. Shasta	7/25/52	256	54	2,000	Near Wise Powerhouse
Rainbow trout	Mobile?	7/15/53	256	54	2,000	Near Lozanos Road
Rainbow trout catchables		5/10 to 7/4/59				Auburn – probably kids fishing program
Brown trout		5/10/89		229	500	Upstream of Marguarite Mine in Auburn – fish kill mitigation
Spring chinook salmon	Feather R. FH	2/20/85	344	54	77,400	Moore Road
Fall chinook salmon	Feather R. FH	1/31/86	480	48	24,000	Garden Bar Road
Fall chinook salmon	Feather R. FH	1/27/87	800	41	50,400	Highway 65
Fall chinook salmon	Nimbus FH	1/13/89	1,072	37	100,700	Goldhill Road.?

Fall chinook salmon	Nimbus FH	1/25/90	1,245	35	124,500	Goldhill Road
Fall chinook salmon	Feather R. FH	2/25/92	764	41	101,612	Goldhill Road
Fall chinook salmon	Feather R. FH	2/19/93	1,165	36	100,190	Goldhill Road
Fall chinook salmon	Nimbus FH	2/3/94	1,100	37	107,800	Goldhill Road
Fall chinook salmon	Nimbus FH	2/3/95	1,040	37	99,840	Goldhill Road
Fall chinook salmon	Nimbus FH	1/10/96	1,200	36	104,400	Goldhill Road
Fall chinook salmon	Nimbus FH	2/27/97	760	41	102,600	Goldhill Road

*Length estimates (mm) from Fish Hatchery Management, Fish and Wildlife Service, 1992.

3. Adult Spawning Timing, Distribution, and Population Estimates

- **1991 Memorandum entitled "Recollection of Auburn Ravine Creek, Coon Creek and Dutch Ravine Creek by Ancle "Slim" Goodall":** This memo documents the memories of Mr. Goodall regarding his fishing and species caught starting in 1939 or 1940. Mr. Goodall fished Auburn Ravine from the Wise Powerhouse downstream to Lincoln. He states it "… was a known fact that steelhead and salmon came up to the Wise Powerhouse back in those days." He personally caught 18" fish and (say) 20" fish were routinely caught in the early days. In the 1960's fishing really slowed down. **Source: May 26, 1991 Conversation documented by Ron Otto.**

- **1964 Fall-Run Chinook Salmon Spawning Survey by Eric Gerstung:** Gerstung conducted a survey of 500 ft. of stream at the Fowler Road Bridge (noted in the records as Silva-Bertholt Bridge in the original memo) on 11/23/64. He saw no carcasses and 15 live fish. He estimated the run size to be 300 fish and indicated, for streams in the area, that the run size was much greater in 1963, although no specific reference to any particular stream was noted. The information on the 1963 run size is not in the CDFG files reviewed. Water clarity was reported as muddy and flow estimated at 25 cfs. **Source: May 25, 1965 memorandum in CDFG, Region 2 files.**

- **December 6, 1985 Spawning Survey:** Auburn Ravine was surveyed for fall chinook salmon on 12/6/85. The stream was survey from approximately ½ mile upstream of Goldhill Road crossing to about ½ mile downstream of the same crossing. There had been a week of rain; visibility was estimated at 18", and flows at 40-50-cfs. A 4ft. waterfall was noted approximately ½ mile upstream of the road crossing. Twelve adult chinook salmon were observed actively spawning from the fall to about ½ mile downstream from the bridge. Most chinook salmon were about 28" but one 40" male was observed. Spot checks were made at Bridge Lane and Fowler Road with no fish observed. Run size was estimated as 100 fish. **Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.**

- **Fall 1986 Salmon Spawning Surveys in the City of Lincoln:** Fred Meyer conducted surveys on four sections of Auburn Ravine in November of 1986. The first survey was conducted on 11/3/86 in the City of Lincoln. Meyer saw 12 salmon. Flow was estimated at 10-12 cfs, but higher flows had occurred before the survey. A second survey of two stream segments was completed on 11/13/86. The first segment included walking for 25 minutes downstream from Highway 65. Fred reported 3 unmarked, live salmon; 3 obvious redds; and 4 carcasses. A local citizen reported seeing 40 fish. The second segment surveyed was from Highway 65 upstream to the Highway 193 Bridge crossing. Meyer recorded 7 dead; 1 live; and over 50 redds. He also reported broken spears and a line of eggs going up the bank. He estimated both age II and age III fish. The population at 200 fish with an additional 100-200 poached. His last survey occurred on 11/17/86 at the Goldhill Bridge with no fish observed. **Source: Fred Meyer memorandum in CDFG Region 2, files.**

- **1/2/92 John Hiscox Memorandum:** In this memorandum, Hiscox documents information regarding a fish sample he received from Ron Otto, in October 1991. Otto states that the fish was caught in early September 1991 and frozen before being given to Hiscox. Hiscox noted the following: fish was 16.2" long and weighed 1.45 lbs.; silver along the sides, no parr marks or striping; fish were intact with no feathering (hatchery origin fish often have deformed fins because of rubbing against the concrete raceway bottoms or walls). Scale analysis indicated that this fish was 2 years old, with widely space circuli and well defined annuli. Hiscox's conclusion is that fish was anadromous. **Source: 1/2/92 Memorandum from John Hiscox, District Fisheries Biologist, CDFG Region 2, files.**

- **11/30/94 Nelson Lane Observations:** Six salmon were sighted below the diversion dam just downstream of Nelson Lane near the Lincoln Airport. The dam was removed two days later and the author heard of salmon sightings further upstream, but was unable to confirm this information. **Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.**

4. Juvenile Distribution and Sampling Data

- **March 3, 1959 Electrofishing Sample:** A one-day electrofishing sample was collected from Auburn Ravine near the Goldhill Road Bridge on 3/3/59. A 350 ft. section was electrofished. Flow was reported as 10 cfs, channel width 15 ft., and pools 2-6 ft. deep. Good fishing was reported upstream of the Bridge. Species captured included: rainbow trout (few); brown trout; suckers; hitch; green sunfish (few). **Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.**

- **Spring 1965 Fall-Run Chinook Juvenile Emigration Survey by Eric Gerstung:** Gerstung began trapping downstream migrant fall-run chinook juveniles in Auburn Ravine just downstream of Fowler Road (noted in the files as Silva-Bertholdt Road) in mid-February 1965 and continued through mid-March (original data sheet missing from the files). Sampling was with a "riffle" trap or perforated plate trap. The trap fished a total of 515 hours and captured 63 juvenile chinook salmon. No other fish species catch composition or specific data is reported. **Source: May 25, 1965 memorandum in CDFG, Region 2 files, handwritten draft of May 25, 1965 memo, and other handwritten notes.**

- **August 1971 One-time Seining Event:** The Department of Fish and Game conducted a one-time seining event on August 27, 1971 at an undefined location in Auburn Ravine. Although no location is given, the stream channel was recorded as being three feet wide, water depth 0.25 ft. deep, with commercial land use next to the stream. Given these conditions, this location was near the City of Auburn. A 50-foot section was electrofished. Catch composition is reported as: 3- rainbow trout (2.2", 3.2", 8.3") and 1- green sunfish (3.9"). **Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.**

- **March 1979 Electrofishing Survey:** The Department of Fish and Game conducted a one-time electrofishing survey at three locations on Auburn Ravine in and near the City of Auburn on 3/20/79. **Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.**

Location	Length Fished	Catch Composition
Auburn Ravine Rd. at Persimmon Ave.	130 yds.	12-rainbow trout (4-7"); 2- green sunfish ((7-8"); 8- roach (1-3")
Placer Terrace Apt. near freeway	100 yds.	10- rainbow trout (4-8" in excellent condition); 1- green sunfish (5"); 1- largemouth bass (2"); 8- roach
Ophir Rd. at Stonehouse Rd. below old sewer plant	100 yds.	No fish captured

Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.

- **1984 Seining and Electrofishing For Native Brood Year 1983 Fall-Run Chinook Salmon:** Water temperatures for this sampling effort are reported above. The following sampling results were reported: **Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.**

Date	Effort	No. chinook	Length Mode (mm)	Length Range (mm)	Other Fish Species	Location
2/28/84	2 seine hauls	1	--	41	1- sucker	Moore Rd.
2/28/84	2 seine hauls	0	--	--	8-suckers	Fowler Rd.
4/2/84	1 seine haul	7	47	43-68	4- rainbow trout; 11- squawfish*; 8- suckers	Fowler Rd.
5/2/84	1 seine haul	2	--	67, 68	11- rainbow trout	Fowler Rd.

5/24/84	1 seine haul	0	--	80, 81	1-sucker	Fowler Rd.

***** Sacramento squawfish are now known as Sacramento pikeminnow.
Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.

- **November 1984 Electrofishing Survey by Sacramento State University Professor Dave Vanicek at the Otto Residence:** Dr. Vanicek conducted an electrofishing survey of approximately 1,000 ft. of stream at the Otto Residence off Wise Road just downstream from the City of Auburn's wastewater treatment facility on 11/3/1984. Water quality and water temperature measurements are reported above. Fish species catch is reported: **Source: Copy of Vanicek's Report in CDFG, Region 2 files.**

Fish Species	N	Fork Length of Individuals (mm)
speckled dace	1	88
green sunfish	1	166
Sacramento sucker	5	138, 146, 148, 153, 202
rainbow trout	26	58, 75, 81, 88, 95, 96, 98, 99, 100, 101, 101, 102, 105, 106, 112, 115, 116, 118, 121, 122, 123, 127, 133, 134, 146, 262

Source: Copy of Vanicek's Report in CDFG, Region 2 files.

- **1985 Electrofishing Record from Dutch Ravine:** The Department of Fish and Game conducted a one-time electrofishing survey in Dutch Ravine at Dutch Court road crossing on 3/26/85. Water temperature was reported as 61 ^{O}F at 1500 hours. Stream is described as low gradient; some gravel; much sand; canopy heavy with berry, alders, and buckeye. A 100-foot section was sampled with one pass and had the following reported catch:

  squawfish – 2 young of the year and 2 – adults
  suckers – 4 young of the year and 4 adults
  one brown trout greater than 150 mm
  one rainbow trout less than 150 mm and 2- rainbow trout greater than 150 mm
  Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.

- **1990 Michael Sarkisian Letter:** Mr. Sarkisian of Newcastle, wrote a letter to the Department of Fish and Game in which he claims to have seen approximately 1,000 salmonid fingerlings, which he believes to be steelhead, in isolated pools west of Lincoln. **Source: Letter from Mr. Sarkisian, received 6/16/1990, CDFG, Region 2 files.**

- **1993 Fish Kill Report: Source:** A fish kill occurred on October 26, 1993 as a result of a discharge from the City of Auburn's wastewater treatment plant near Auburn. All fish for approximately 1-2 miles downstream from the discharge location were apparently killed. Estimates of the number killed are based on electrofishing the next day, upstream from the discharge. Dead fish were reported as rainbow trout, sucker, squawfish, and hardhead. The official loss report estimates the losses as 6,400 rainbow trout from 1.5"-10" in length; 8,000 suckers from 4"- 18" in length; and 950 hardhead 3 inches in length. No estimates of squawfish losses are reported. Local citizens reported rescuing several 12"-16" rainbow trout, all of which later died. The length range of rainbow trout indicates probably 4 age classes were present. **Source: October 26, 1993 Fish Kill Report, CDFG, Region 2 files.**

- **1995-1996 Monitoring Results from the 1996 City of Auburn, Draft Auburn Wastewater Treatment Plant Stream Study:** Attachment 3 of this document describes the results of electrofishing subsampling that occurred in six reaches of Auburn Ravine downstream from Interstate 80 to a point approximately 1,500 feet downstream from the Lozanos Road Bridge. Sampling was conducted in October 24-28, 1995 and again from April 4-9, 1996. Sampling results for steelhead/rainbow trout are presented in Attachment 3, Tables 8a and 8b, respectively. The October 1995 results indicate an extremely productive trout stream with 4 of 6 reaches having an estimated steelhead/rainbow trout biomass exceeding 125 lbs/linear mile of stream. April 1996 biomass estimates ranged from 14-62 lbs/linear mile but average fish size remained about the same, with only small increase in average length. I speculate that much of the biomass emigrated to downstream areas and/or to the ocean as steelhead smolts. This scenario would be consistent with a normal steelhead stream and appears to be supported by data presented in Figures 14 and 15 in Attachment 3. **Source: 1996 City of Auburn, Draft Auburn Wastewater Treatment Plant Stream Study.**

- **1999 DEIR City of Lincoln Wastewater Treatment and Reclamation Facility:** This DEIR (Appendix F, Table F-4) documents fish sampling conducted by Jones and Stokes Associates in November 1997 and Bailey Environmental/Dean Carrier and Associates in November 1998 (Appendix Table F-5). These sampling efforts document many of the species listed in the "Documented Fish Species Present in the Stream" section of this report. The major exception is that no chinook salmon were captured, but this would be expected because of the low water which prevented adult access in November 1997 or 1998 and juveniles would have left the stream the previous spring. Bailey Environmental sampling documented the presence of steelhead smolts (juveniles approximately 150 in length and having silvery sides with no parr marks). Approximately 50% of the juvenile steelhead captured had or were under going parr/smolt transformation. The remaining 50% had not yet started to turn color, but were on average about 25 mm shorter. These fish would be expected to smolt before spring and move to the ocean during spring flows. **Source: DEIR City of Lincoln Wastewater Treatment and Reclamation Facility, September 1999.**

- **Reports of "Half-Pounder" Steelhead in Auburn Ravine:** There is a growing body of anecdotal evidence to suggest that steelhead that exhibit this particular life history pattern enter Auburn Ravine in the spring and migrate to upstream areas. Half-pounders exhibit an unusual life history pattern in that they migrate as young adults (usually spending only one year in the ocean or estuary) into their natal streams in late spring and through the summer if stream conditions are right. A number of streams on the coast of California have half-pounder runs. Information that supports such a finding includes:

  (a) Conversations with Dr. Ron Otto, who lives in the Ophir area, who is a highly knowledgeable steelhead fisherman. Otto has continually caught steelhead in the15"-20" range near his home on Auburn Ravine during the summer and early fall time periods, certainly before fall rains and removal of diversion dams would have permitted fish to migrate into the stream. He has documented lengths and has photos of fish that are obviously silvery in color and have not been in freshwater for any length of time.

(b) The conclusion of John Hiscox, Department of Fish and Game District Biologist that a fish caught in early September by Dr. Otto was anadromous in origin (see details above in this chapter).

(c) Statements on page 3-80 of the DEIR/DEIS City of Auburn Wastewater Treatment and Disposal Master Plan for the City of Auburn, prepared by Quad Consultants and Dewante and Stowell Consulting Engineers. This document indicates that half-pounders are known to utilize Auburn Ravine for spawning during the winter. No specific reference is cited. However, Dennis McEwan, Department of Fish and Game steelhead specialist (Department of Fish and Game Fish Bulletin 179 "Contribution to the biology of Central Valley Salmonids", Volume 1) states that no summer steelhead runs occur in the Central Valley. The behavior of these fish in Auburn Ravine, entering in late spring is atypical of normal winter migrating adults found in the rest of the Central Valley.

(d) Observations by Mark McClure, Lincoln resident, to Randy Bailey, Bailey Environmental. McClure said that on July 9, 2002 he had observed three steelhead (about 20" to 22"long) in a pool approximately 100 yards downstream from the Joiner Parkway Bridge in the City of Lincoln. Mr. McClure is a City of Roseville fireman and an avid fisherman. I have questioned him on several occasions regarding his general knowledge of fish and fish behavior. I find his account totally plausible based on his knowledge of the species and the water temperature data for that time period recorded at the NID gaging station located about 1 mile upstream from the subject location.

(e) Riley Swift, owner of Restoration Resources, reported to me that Tim Pafford, a fish biologist employed by Riley, had seen what he (Pafford) believed to be half-pounders jumping at the face of the South Sutter Diversion Dam on the Aitken Ranch in May 2003 or possibly 2002. This report is especially important because the timing of the installation of South Sutter's various diversion dams usually occurs in mid-April, after being down all winter when normal adult winter steelhead would be migrating.

(f) A 5/10/94 letter from the Department of Fish and Game (copy in Region 2 files) to Jim McKevitt (at that time head of the Central Valley Project Improvement Act Program for the U.S. Fish and Wildlife Service) regarding the needs for Auburn Ravine. One of the concerns expressed by the Department was the need to get steelhead upstream of NID's Auburn Ravine #1 Diversion Dam [I assume] on a consistent basis. Fish move over the dam (located upstream of Goldhill Road and consisting of an 11 ft. high concrete arch dam across the channel) on high flows. The Department suggests that a fish ladder is needed at this location (See a more detailed discussion of fish passage at this site below).

F. Fish Passage or Screening Data

1. Man-Made Structures or Pumping Stations. The following information is abstracted from the reconnaissance level survey of the various diversion dams located in Auburn Ravine, completed by James Buell, PhD and reported in detail in the April 2002Auburn Ravine/Coon Creek Ecosystem Restoration Plan in the watershed area of interest to this assessment. The reader should note, that none of the recommendations for action considered the presence and migratory timing of half-pounder steelhead migration in the spring or early summer. Since this concern has been more fully documented, Dr. Buell and I have discussed ways in which to provide upstream fish passage for half-pounders. Recommendations developed during these discussions are presented. These recommendations would provide implementable solutions to fish passage at relatively modest cost at most locations.

- **Nevada Irrigation District Gaging Station**

(a) **Location:** The site is located about 1/4 mi downstream of SR 65 in the City of Lincoln.

(b) **General Description**: This structure is a full channel width concrete section installed in association with a recording stream gage owned and maintained by Nevada Irrigation District. The section forms a broad flume with vertical sides, an upward-sloping approach, and a level crest with an ogee shape descending to a horizontal apron which spills onto large boulders to dissipate energy and prevent undermining. The flume and crest section is 25 ft wide, with flaring upstream and downstream sidewalls.

(c) Assessment: This structure is a significant impediment to upstream anadromous fish migration at all but extremely high flows, when the structure would become drowned out. Good passage requires either swim-up conditions (preferred) or the combination of a plunge pool with a standing wave, height of the obstruction less than the leaping ability of the fish, and quiescent "receiving water" conditions at the top of the obstruction into which the fish can leap. None of these conditions is met at this site under most stream flow conditions (when the structure is drowned out, swim-up conditions are likely present). Since this assessment was initiated, NID has performed maintenance at the downstream edge of this structure. A field of boulder riprap was placed below the downstream lip of the structure to prevent further erosion and undermining of the structure. This configuration is now probably a barrier to fish passage under low to moderate flows.

(d) **Priority for Attention:** High.

(e) **Alternative Approaches:**

Formal Fishway **–** This alternative would involve construction of a formal engineered fishway around the site. Recommended configuration for this alternative is a vertical slot and orifice fishway of standard design. Location should be on the right bank if maintenance access across adjacent private land can be obtained (to reduce poaching and vandalism risks) or on the left bank if such access can not be obtained. If the structure is constructed on the left bank, which would be easily accessible to vandals and poachers (high risk at this site), the fishway should be completely covered with a heavy-duty locked grating. Maintenance during the migration season should be at least weekly, to keep the fishway clear of obstructing debris. If this alternative is implemented, the entire complex would have to be re-rated to calibrate the stream gage. Some minor loss of precision may result due to increased hydraulic complexity, especially if debris is allowed to accumulate in the fishway.

Pool-and-Chute Replacement **–** This alternative would involve the replacement of the existing concrete section with an engineered "Pool-and-Chute" fishway spanning the entire channel. These structures are essentially a series of shallow-angle "V" weirs with a central notch to the structure floor about 1 ft in width. Although relatively new in design, this structure is well tested, and provides good passage conditions for both adult and juvenile anadromous fishes under a very wide range of flow. The formal design of these structures is conducive to the development of rather precise stage-discharge relationships, making this alternative a suitable substitute for the existing section at this stream gaging site. Naturally, the gage would have to be re-rated, but the resulting precision would likely be as good or nearly as good as the existing flume section, and superior to the combination of the existing structure and a circumventing formal fishway.

Backwater Existing Section **–** This alternative would involve placing a series of low, very shallow angle "V" weirs across the channel downstream of the existing concrete section to backwater the existing section to the point where swim-over conditions were achieved for most stream discharges typical of the anadromous fish upstream migration season. Implementing this approach would seriously compromise the precision of the gaging station. More importantly, this approach would significantly reduce the conveyance capacity of the channel immediately downstream of the gage, resulting in increased flood risk. Although technically feasible with accompanying flood protection measures, this approach is probably not practical.

(f) **Recommendation:** The "Pool-and-Chute Replacement" alternative is recommended.

- **Davis Dam**

(a) **Location:** Davis Dam is located between the Pleasant Grove Road crossing and the Union Pacific Railroad tracks in Sutter County.

(b) **General Description:** Davis Dam is a seasonal flashboard dam in a highly modified reach of Auburn Ravine on the valley floor. The 12 ft wide rectangular concrete abutments are 40 ft apart, connected by a concrete slab on the channel invert. A major water turnout is located immediately upstream on the right bank, consisting of an unscreened 42 in diameter culvert with a knife gate, operated by a wheel. This dam is in operation annually from 15 April to 15 October.

(c) **Assessment:** The seasonal operation of this dam means that it is not a significant impediment to upstream-migrating anadromous fish in most if not all years. This facility is on the valley floor in an area where water temperatures are not conducive to year-round rearing of anadromous fish. In addition, most active downstream migration of smolts in most years is outside the irrigation diversion season. For these reasons, screening the turnout adjacent to Davis Dam, and other diversions (pumped or gravity) in this area should be considered a low priority action, if it is justified at all.

(d) **Priority for Attention:** Low.

(e) **Alternative Approaches:** None developed.

(f) **Recommendation:** No change.

- **Tom Glenn Dam**

(a) **Location:** Tom Glenn Dam is located on Auburn Ravine

(b) **General Description:** Tom Glenn Dam is a seasonal flashboard dam on a highly modified reach of Auburn Ravine on the valley floor. The trapezoidal abutments are 40 ft apart, connected by a rough, 8 ft broad ogee-shaped concrete sill with a downstream transition into a short "flip-lip". The "flip-lip" is broken away on the right side, but the structure does not appear to be at risk of undermining. Tom Glenn Dam is operated annually from 14 April through 15 October.

(c) **Assessment:** The seasonal operation of this facility means that it is not a significant impediment to upstream-migrating anadromous fish in most if not all years. In spite of the elevated sill, in its flashboards-out condition, this structure does not present a significant impediment to upstream anadromous fish migration, partially because of the broken condition of the "flip-lip" near the right abutment; if this were repaired, this structure would become a minor impediment at low flows, but at higher flows, typical of most upstream migration periods, a swim-over condition would be present. This facility is on the valley floor in an area where water temperatures are not conducive to year-round rearing of anadromous fish. In addition, most active downstream migration of smolts in most years is outside the irrigation diversion season.

(d) **Priority for Attention:** Low.

(e) **Alternative Approaches:** None developed.

(f) **Recommendation:** No change.

- **Aitken Ranch Dam**

(a) **Location:** This dam is located on the Aitken Ranch, just west of Fiddyment Road.

(b) **General Description:** Aitken Ranch Dam is a seasonal flashboard dam on a modified reach of Auburn Ravine on the valley floor. The trapezoidal abutments are 26 ft apart and are connected with a concrete sill even with the channel invert. The abutments support a flat car bridge. Aitken Ranch Dam is operated annually from 15 April through 15 October.

(c) **Assessment:** The seasonal operation of Aitken Ranch Dam means that it is not a significant impediment to upstream-migrating anadromous fishes in most years. This modified (channelized) reach of Auburn Ravine has physical habitat features which could support rearing juvenile anadromous fish, and temperatures in this part of the valley floor during at least part of the irrigation season would also support populations of these fish in some years. Although no diversion is located in the immediate vicinity of this structure, those within its influence upstream are unscreened, and may be candidates for screening.

(d) **Priority for Attention:** Low for dam; medium for unscreened diversions in this reach.

(e) **Alternative Approaches:** None for upstream passage. Unscreened diversions under the influence of Aitken Ranch Dam were not directly observed, but simple rotating drum screens meeting anadromous fish screening criteria (3/32 in clear space screens sized to achieve < 0.4 fps approach velocity with internal porosity control) would likely be appropriate for pumped diversions. Gravity diversions, if any are present in this area, should be assessed for screening feasibility; vertical flat plate screens meeting the above criteria and with automatic wiper systems for cleaning would likely be the best approach if screens are deemed necessary.

(f) **Recommendation:** Do nothing for upstream passage. Assess unscreened diversions and seasonal stream temperatures, perhaps in conjunction with fish surveys to establish juvenile anadromous fish presence during the irrigation season, to determine if screens are needed.

- **Moore Dam**

(a) **Location:** Moore Dam is located on Auburn Ravine just upstream of Moore Road.

(b) **General Description:** Moore Dam is a seasonal flashboard dam on a somewhat modified reach of Auburn Ravine on the valley floor. A relatively wide expanse of semi-natural channel and riparian corridor extends upstream of the dam structure. The rectangular abutments are 56 ft apart and are joined by a concrete slab on the channel invert. Moore Dam is operated annually from 15 April to 15 October. A major water turnout is located in an alcove off the main Auburn Ravine channel about 70 ft to the right of the right abutment, and is controlled by twin knife gates on two 36 in diameter culverts passing under an access road to a canal.

(c) **Assessment:** The seasonal operation of Moore Dam means that it is not a significant impediment to upstream-migrating anadromous fishes in most years. This reach of Auburn Ravine has physical habitat features which could support rearing juvenile anadromous fish, and temperatures in this part of the valley floor during at least part of the irrigation season would also support populations of these fish in some years. The diversion located in the immediate vicinity of this structure is unscreened, and may be a candidate for screening, along with others in this general area. The appropriateness for screening should depend on future investigations and temperature data review to see if they indicate that there is a significant risk to rearing anadromous fish populations in the general vicinity during the irrigation season.

(d) **Priority:** Low for passage. Medium for unscreened diversions in this reach (pending results of temperature data review).

(e) **Alternative Approaches:** If screening is deemed appropriate, simple rotating drum screens meeting anadromous fish screening criteria (3/32 in clear space screens sized to achieve < 0.5 fps approach velocity with internal porosity control) would likely be appropriate for pumped diversions. Gravity diversions, such as the turnout in direct association with Moore Dam, should probably be fitted with vertical flat plate screens meeting the above criteria and with automatic wiper systems for cleaning would likely be the best approach. In this case, the screen should be placed diagonally across the alcove with the downstream end on the left (looking in the direction of water flow. At that point, a 6 in diameter bypass pipe should be buried under the ground separating the right dam abutment from the alcove, with the bypass terminus in the scour pool below the dam.

(f) **Recommendation:** No upstream passage improvements are needed. Assess unscreened diversions and seasonal stream temperatures, perhaps in conjunction with fish surveys to establish juvenile anadromous fish presence during the irrigation season, to determine if screens are needed.

- **Nelson Lane Dam**

(a) **Location:** Nelson Lane Dam is located on Auburn Ravine approximately ¼ mile downstream of Nelson Lane near the Lincoln Airport.

(b) **General Description:** Nelson Lane Dam is a seasonal flashboard dam on Auburn Ravine in the lower elevation foothills above the valley floor. The trapezoidal abutments are 60 ft apart and are joined by a declining concrete slab on the channel invert. Nelson Lane Dam is operated annually from 15 April to 15 October in most years. A major pumped water diversion is located at the end of a long alcove off the main Auburn Ravine channel about 120 ft to the right of the right abutment. Four operating unscreened pumps are present with 8-10 inch diameter pipes extending into the alcove pool.

(c) **Assessment:** The seasonal operation of Nelson Lane Dam means that it is not a significant impediment to upstream-migrating anadromous fishes except at lower stream flows which may characterize portions of the migration period in some years. The tipped slab between the abutments creates a high-velocity area (super-critical flow) at lower discharge. This forces the water to become significantly shallower at this point and could create a significant impediment if lower stream flows persist. The water temperatures in this part of the Auburn Ravine watershed could support populations of rearing salmonid juveniles for at least portions of the irrigation season, making these fish vulnerable to entrainment by unscreened pumps associated with this facility. The location of the pumps at the end of an alcove with significant channel length means that if fish are actively migrating, they may enter a dead-end channel with downstream cues, leading to potentially significant migration delay.

(d) **Priority for Attention:** For upstream passage, medium. For pump screening, medium (pending review of temperature data and risk analysis).

(e) **Alternative Approaches:**

Upstream Passage **–** Pending discharge frequency data review and needs analysis, rock-bolt 10 x 10 inch treated timbers across the tipped concrete apron immediately downstream or immediately upstream of the flashboard channel supports, leaving a 1.5 - 2 ft wide gap in the middle of the span. This will form an attraction jet and concentrate flow into a deeper pattern, enabling passage at lower discharges. Clear out some of the rock debris in the pool immediately downstream of the concrete sill, as necessary.

Pump Screens **–** Pending water temperature data review and risk assessment, install vertical, rotating drum screens on each of the four pumps. Install a treated lumber wing-wall across the alcove near the pumps, leaving a gap of 3-4 ft between the end of the wall and the right alcove bank. This will force water flowing toward the pumps to approach from the right side of the pump line and pass along the line toward the left alcove bank. Install a 6 in diameter bypass pipe leading from the left alcove bank through the ground separating the alcove from the main Auburn Ravine channel, terminating below the sloping concrete sill between the dam abutments. Excavate a pool at the end of the pipe and submerge the outlet to kill the jet. This arrangement will create a sweeping flow along the row of pumps toward the bypass pipe and provide a downstream migration cue guiding fish to the bypass. It will only be necessary to operate the bypass during the downstream migration period.

(f) **Recommendation:** Perform need (upstream passage) and risk (pump screening) analyses. If improvements are indicated by the analyses, implement the alternatives described above.

- **Lincoln Ranch Duck Club Dam**

(a) **Location:** Lincoln Ranch Duck Club Dam is located approximately one mile upstream of the Brewer Road crossing.

(b) **General Description:** Lincoln Ranch Duck Club Dam is a seasonal flashboard dam on a highly modified reach of Auburn Ravine on the valley floor. The rectangular abutments are 27 ft apart and connected by a concrete sill. The abutments are spanned by a flatcar bridge. A gravity water turnout is located on the right bank of Auburn Ravine immediately upstream of the right dam abutment. A pumped diversion fitted with a trash screen is set into the left bank of Auburn Ravine immediately upstream of the left dam abutment. Lincoln Ranch Duck Club Dam is unusual in that it is operated into late November (1998 data), well into the upstream migration season for adult salmonids. [Note: recent information indicates that this situation has been resolved, but the information is anecdotal and should be confirmed by discussions with the landowner and/or ranch manager.]

(c) **Assessment:** The unusual seasonal operation of this facility makes it a special case when assessing potential effects on upstream migration of anadromous fishes. The water surface elevation difference with flashboards in can be as much as 6 ft, depending on total stream flow. During higher flows, steelhead and chinook salmon can obviously negotiate this structure, since these species are known to reproduce at higher elevations in the watershed. However, this facility undoubtedly forms a significant impediment to upstream-migrating salmon and steelhead for a significant early part of the migration season. For this reason, passage improvements are desirable. The extended use of the associated pumped water diversion also poses some risk of entrainment of juvenile salmonids, especially small fry during initial dispersal following emergence from incubation. Although anadromous fish spawning is not thought to occur in the immediate vicinity of Lincoln Ranch Duck Club Dam, initial dispersal often transports fry considerable distances downstream. For this reason, screening this diversion, at least on a seasonal basis is considered desirable. A more complete evaluation, possibly incorporating sampling for fry presence during periods of operation, should be conducted prior to allocating significant expenditures for fish screens at this site, however.

(d) **Priority for Attention:** For upstream passage, medium to high, depending on water conditions during the upstream migration season. For diversion screening, low to medium, depending on a more thorough evaluation of seasonal entrainment risk.

(e) **Alternative Approaches:**

***Upstream Fish Passage* –** This site is not well suited for a formal fishway bypassing the flashboard structure.

<u>Pool excavation; pump extension</u> -- This approach would involve excavating a pool or sump immediately upstream of the existing flashboard dam structure at the location of the diversion pump, and extending the pump tube into the sump. This would allow continued operation of the flashboards in the present manner, posing no change in upstream flood risk. The sump would have a tendency to accumulate fine sediment, however, potentially interfering with pump operation or increasing mechanical wear and maintenance costs. This might be successfully offset by installation of "vortex weirs" at the entrance to the

sump, which are designed to capture and concentrate bed load and “saltating” fine sediments and send them downstream. Some increase in energy costs would be incurred due to increased lift requirements.

Pool and chute fishway -- This approach would involve replacement of the existing flashboard dam structure with a formal “pool-and-chute” fishway section across the entire Auburn Ravine channel. This structure would permanently raise the invert elevation of the Auburn Ravine channel at this point, increasing the risk of flooding upstream in the event of very high discharge (no flashboard adjustment would be possible). The pool behind the structure would have a tendency to fill with fine sediment, potentially interfering with pump operation or increasing mechanical wear and maintenance costs. No increased energy cost would be incurred, however.

***Screening* –** Pending an entrainment risk analysis demonstrating need, the diversion pump could be fitted with a vertical drum screen meeting appropriate fish screen criteria (3/32 in clear space screens sized to achieve 0.4 fps approach velocity with internal porosity control). A hydraulic analysis of the expected flow net in the immediate vicinity of the screen should be performed to determine whether a simple rotating screen or a back-flush or wiper system would be most appropriate for screen cleaning.

(f) **Recommendation:** For upstream-migrating anadromous fish passage, implement the first alternative described above. Analyze the appropriateness of use of “vortex weirs” and develop a maintenance schedule accordingly. Perform an entrainment risk analysis, and install a drum screen if indicated by the analysis.

- **NID Diversion (Hemphill Dam)**

(a) **Location:** Hemphill Dam is located on Auburn Ravine upstream of the City of Lincoln, adjacent to the Turkey Creek Golf Course.

(b) **General Description:** Hemphill Dam is a relatively large seasonal flashboard dam on a slightly modified reach of Auburn Ravine in the low elevation foothills of the watershed near the Turkey Creek Golf Course. The trapezoidal dam abutments are about 8 ft high and 64 ft apart, connected by an elevated horizontal concrete sill. A relatively smooth gunnited rubble apron slopes downstream from the concrete sill to a plunge pool filled with large angular boulders for energy dissipation. Banks upstream and downstream of the abutments are about 75 ft apart and are protected by large gunnited rip-rap. This bank protection is more prominent on the right bank, extending about 75 ft upstream and 60 ft downstream of the abutments. An unscreened gravity diversion with a knife gate control and a sloping trash rack is located on the left bank about 50 ft upstream of the left dam abutment. The elevation of the sill between the dam abutments is about 6 ft above the natural invert of the stream channel, and the relatively smooth gunnited rubble apron produces very shallow super-critical sheeting flow at low to moderate stream flows.

(c) **Assessment:** At most stream flows, including flows representative of those occurring during the adult anadromous fish migration season, the configuration of the sill and apron at Hemphill Dam produces super-critical flow for a distance of at least 30 ft. This results in a velocity barrier condition for upstream-migrating anadromous fish at all but very high stream flows when the entire structure becomes drowned out and swim-over conditions would be present. The relatively greater bed roughness on the apron near the right abutment may ameliorate this condition somewhat, reducing passage difficulties at moderately high stream flows, but this structure would still probably be considered an impediment, potentially resulting in migration delays or "encouraging" fish to spawn further downstream than would otherwise be the case. It should be noted that there is some very good spawning habitat for chinook salmon, and possibly steelhead, in the reach downstream of Hemphill Dam. The gravity diversion is unscreened, and would present a threat of entrainment of juvenile salmonids present during periods of operation. Since this facility is in the low elevation foothills of the Auburn Ravine foothills, water temperatures would likely support rearing populations of juvenile salmonids during part of the irrigation season. In addition, as noted above, relatively good spawning habitat is present in the general vicinity of Hemphill Dam, suggesting that populations of rearing anadromous fish may well be present during portions of the irrigation season in at least some years. This suggests that screening the diversion in association with Hemphill Dam, and others in the general vicinity is appropriate.

(d) **Priority for Attention:** For upstream anadromous fish passage, high. For diversion screening, medium to high, depending on results of a risk assessment (perhaps including sampling for rearing anadromous fish presence during portions of the irrigation season).

(e) **Alternative Approaches:**

***Upstream Fish Passage* –** Upstream fish passage at this site could be provided in two ways.

<u>Pool and chute fishway --</u> This site is very conducive to installation of a pool and chute fishway spanning the entire Auburn Ravine channel. This structure would replace the existing gunnited rubble apron immediately downstream of the horizontal concrete sill connecting the dam abutments. Little or no change in channel conveyance capacity is anticipated for this approach. If detailed hydraulic analysis indicates that channel conveyance capacity would be reduced, it is expected that this change would be minor and could be mitigated by a slight increase in channel width at the dam site, which could be accomplished by moving one of the abutments back an appropriate distance. This approach would assure good passage conditions at all migration season discharges when the dam is in its flashboards-out condition. Advantages of this approach include essentially maintenance-free operation, good to excellent passage conditions under all or nearly all flow conditions, no migration delay and limited or no poaching/vandalism opportunities. Disadvantages include potential for slight decrease channel conveyance capacity and possibly relative cost.

Backwater the apron and add roughness -- This approach is similar to the pool and chute fishway described in the first alternative, above, but less formal in execution, with a less reliable outcome. Backwatering of the Hemphill Dam apron would involve construction of a series (probably three) of low, shallow "V" weirs, with each consecutive "V" 12-18 in higher in elevation than the one downstream. The furthest upstream "V" should be located near the toe of the existing apron. Roughness elements ("dentates") should be added to the apron near the crest to break up sheeting flow and provide hydraulic complexity. Advantages of this approach include good passage conditions over a wide range of stream flows while the dam is in the flashboards-out configuration, essentially maintenance-free operation, no significant migration delay, limited poaching/vandalism opportunities, and potential cost savings over the first alternative. Disadvantages include a larger construction footprint than the first alternative and a slightly increased potential for reducing overall channel conveyance capacity at the crest of the apron in the flashboards-out configuration. This last disadvantage could be overcome by moving one of the abutments back an appropriate distance, if deemed necessary.

Formal slotted fishway -- This approach would involve design and construction of a formal fishway around Hemphill Dam. Adequate space exists on either side of the dam, but each side has advantages and disadvantages. Advantages of the right side include lower poaching and vandalism opportunities. Disadvantages of the right side include more difficult construction and maintenance access, probably involving right-of-way acquisition. Advantages of the left side include easy construction and maintenance access and probably little or no difficulty obtaining a right of way or easement. Disadvantages include increased poaching and vandalism risk and an alignment conflict with the existing diversion canal, requiring an inverted siphon in the canal under the fishway alignment. Other advantages of this general approach include potentially lower cost and no risk of reduction of channel conveyance capacity. Other disadvantages of this general approach include a narrower range of ideal operating conditions relative to Auburn Ravine stream flow, increased overall risk of vandalism and poaching, and regular maintenance requirements.

Screening **–** If screening the gravity diversion is warranted by an entrainment risk analysis, the most appropriate approach for this site is a vertical flat plate screen meeting appropriate anadromous fish screening criteria (3/32 in clear space screen; 0.4 fps approach velocity) constructed flush with the left bank in the approximate location of the existing diversion. The screen should have a mechanical wiper for cleaning which could be driven mechanically or by hydraulic motor off a paddle wheel in the diversion canal. If water depth is insufficient to achieve necessary screen area without excessive length, the screen panel could be sloped, but the slope should not be flatter than 45 off the vertical with a mechanical wiper cleaning device. If the screen is flatter than 45 , an air burst cleaning system should be considered, but this would require pulling power to the site and installing a compressor and pressure accumulator tank, along with appropriate controls and sensors. The mechanical wiper system is by far the simpler system, and would require less maintenance and a lower capital outlay.

(f) **Recommendations:** For adult fish passage, implement the pool-and-chute fishway alternative on a high-priority basis, pending results of a uniform engineering cost estimate (if such a cost estimate favors the backwatering/roughness approach, implement that alternative instead). For screening, assuming an entrainment risk assessment indicates the need for screens, implement the described approach.

- **Ophir Tunnel Cataract**

(a) **Location:** The cataract at Ophir Tunnel is located just upstream of Lozanos Road on Auburn Ravine

(b) **General Description:** A steep cataract is located on Auburn Ravine immediately adjacent to the outlet of Ophir Tunnel. The flows over the cataract exhibit much hydraulic complexity passing over a very rough bed, except at the lower end, where the rock is smoother.

(c) **Assessment:** This cataract is clearly an impediment to steelhead at lower stream flows, but is probably passable to some fish at high stream flows. Because of the smoother bed and reduced hydraulic complexity at the lower end, this part of the cataract is the more difficult part for fish to negotiate. Some improvement in passage conditions over a wider range of flows could be achieved by backwatering the lower end of this cataract, giving fish an opportunity to reach more complex portions of this area with less effort and fewer trials.

(d) **Priority for Attention:** Medium.

(e) **Alternative Approaches:** The most cost effective approach to improving steelhead passage conditions at this impediment is to backwater the lower end of the cataract with a series of two or three low, shallow “V” weirs installed across the plunge pool immediately downstream. Crest elevations of these weirs should be 12 to 18 in apart; the weirs themselves should be about 10 ft apart, with the most upstream in the series about 10-12 ft downstream of the existing toe of the cataract.

(f) **Recommendation:** Implement the approach described above on a medium priority basis.

- **Nevada Irrigation District Auburn Ravine 1 Dam**

(a) **Location:** Nevada Irrigation District (NID) 1 Dam is located on Auburn Ravine off Chili Hill Road.

(b) **General Description:** NID 1 Dam is a gravity arch dam in the middle of the Auburn Ravine watershed. The level crest of the dam is about 8 ft above the tailwater during normal stream flows. The pool behind the dam feeds an unscreened gravity diversion to the NID ditch on the north side of Auburn Ravine. The ditch is lined with gunnite for most of its length in this area. A sluice gate for flushing sediment, which accumulates behind the dam, is located on the north side of the crest near the entry to the ditch. Channel depth below the dam is deeper on the south side, with boulders and bedrock protruding from the tailwater on the north side during normal stream flows.

(c) **Assessment:** This dam is clearly a migration barrier to upstream-migrating salmon and steelhead except at high stream flows approaching drown-out, when it would become an impediment. The level crest distributes overflow evenly. Greater channel depth on the south side of the channel opposite the ditch would tend to encourage fish to congregate in that area under most flow conditions, making an accessible solution more difficult. A formal fishway on the south side of the dam is probably not feasible, due to severe access difficulties. Protruding bedrock formations on the north side of the channel below the dam add difficulty to a passage solution in that area. Presence and operation of the sediment sluice next to the ditch add complexity to a passage solution on the north side of the dam. Much of the best steelhead habitat in the Auburn Ravine watershed is located upstream of this facility, increasing the importance of a passage solution here. This part of the Auburn Ravine watershed contains excellent anadromous fish rearing habitat and water quality. Since juvenile anadromous fish are present in this area on a year-round basis, screening the approximately 100 cfs diversion is important.

(d) **Priority for Attention:** For upstream passage: high; for diversion screening: high.

(e) **Alternative Approaches:** Any passage solution on the south side of NID 1 Dam is plagued with virtually impossible access problems, effectively eliminating this area from consideration. Stepping up the stream channel below the dam would severely reduce channel conveyance capacity immediately below the dam, threatening the ditch and control works during high stream flows, effectively eliminating this approach as a viable solution candidate. The only remaining approach is to construct a formal fishway on the north side of the dam, in association with the canal, in spite of the presence and operation of the sediment sluice system in this area and protruding bedrock on this side of the channel immediately downstream of the dam. An integrated adult fishway and screen/bypass system is probably feasible. This approach would involve removing some of the bedrock outcrop on the north side of the channel (without threatening ditch or dam integrity) and constructing a slotted fishway structure on the south side of the existing ditch, possibly using remaining bedrock as foundation. The entry (downstream end) of the fishway should have multiple entry ports to provide entry “choices” under a variety of hydraulic conditions. Supplemental attraction flow in the form of a jet angled obliquely across the deeper water channel on the south side of the channel may improve fishway performance, and should be considered. The exit (upstream end) of the fishway should be into the existing canal. It should be located far enough downstream to serve as the juvenile bypass for a diagonal vertical flat plate screen meeting anadromous fish screen criteria (3/23 in clear space screen; 0.4 fps approach velocity). Assuming 4 ft submergence, gross screen area requirements for an assumed 100 cfs ditch capacity and some room for civil works and screen cleaning system mechanical systems; the fish screen structure would probably occupy 70-75 ft of channel length. Since the fishway slope would probably be about 1:10 - 1:15, this location could allow sufficient distance to achieve necessary elevation gain. The screen wiper system for cleaning could be activated by pulling power to the site or by using a paddle wheel in the canal. Head loss associated with this system could probably be held to about 6 in if the screen is kept relatively clean. Under normal operating conditions, judging from water stains along the canal sufficient head is available. Some freeboard on the outer ditch wall may be necessary in the immediate vicinity of the screen system. It is possible that adult anadromous fish will have difficulty finding the fishway entry under some stream flows even with a supplemental attraction flow jet. If this proves to be the case, thought should be given to adding a very gradually sloping crest to the arch dam, with the crest about 4-6 in higher on the south side. This will gradually concentrate overflow moving along the crest, tending to pull fish to the north side of the channel, in spite of greater channel depth on the south side. This feature should only be added if deemed necessary through performance monitoring.

(f) **Recommendation:** Implement the described approach on a high priority basis.

2. Water Flows

Fall and winter water flows are particularly important in Auburn Ravine. Because water deliveries are curtailed, generally before fall-run chinook salmon attempt to migrate upstream to spawn, the depth of water in the channel can be insufficient to provide adult passage. Adult chinook salmon and steelhead need approximately 1± foot of water depth with some resting pools in order to migrate upstream. Transit time for adult fish from the Cross Canal confluence to upstream of Highway 65 could routinely be accomplished in one to two days. However, adequate water depth is critical and should be taken into consideration concurrently with any fish passage projects for this drainage. Until water temperatures became too warm to allow safe entry into Auburn Ravine, flows downstream of diversion dams in the spring would be needed to pass half-pounder steelhead and allow migration into upstream areas. Another potential problem that has not been adequately addressed is the attraction of adult salmonids to the new discharge location of the new Lincoln wastewater treatment facility. While fish may be prevented from entering the discharge, the volume of water potentially discharged will be enough to provide routine fall/early winter passage for adult salmonids. However, once adult fish reach the location of the discharge, they potentially face a stream channel with little or no flow for miles. The area in which the discharge is located is not suitable for anadromous fish spawning.

3. Beaver Dams

Beaver dams and beaver activity in general are a major impediment to adult anadromous fish passage in this watershed. During the stream videography project, five major beaver dams were documented between the confluence with Eastside Canal and the Goldhill Road crossing on March 12, 2003. In addition two major beaver dams were located in the City of Lincoln approximately ½ mile downstream of Highway 65 and within the NID gaging station about a ¼ mile downstream of Highway 65. The dam in the NID gage was 4 feet tall and combined with the 4 foot drop at the downstream end of the structure, with no jumping pool, this situation was a barrier throughout the winter of 2002-2003.

APPENDIX AUBURN RAVINE 1

HEAVY METALS COMPARISON
BETWEEN AUBURN RAVINE AND EASTSIDE CANAL

	Assumes a Hardness of 50 mg/l as $CaCO_3$ METAL	Maximum Concentration (Acute) (mg/l)	Continuous Concentration (Chronic) (mg/l)			
	Barium	No standard	No standard			
	Cadmium	0.002	0.0013			
	Copper	0.007	0.005			
	Zinc	0.067	0.066			
Stream	**Location**	**Date**	**Cadmium mg/l**	**Copper mg/l***	**Zinc mg/l**	**Notes**
Auburn Ravine	Sutter County	01/25/01	0.000020	0.00381	0.00436	Hardness = 55 mg/l
Auburn Ravine	Sutter County	03/01/01	0.000024	**0.00571**	0.00482	Hardness = 70 mg/l
Auburn Ravine	Sutter County	04/05/01	0.000009	0.00201	0.00249	Hardness = 36 mg/l
Auburn Ravine	Sutter County	05/03/01	0.000006	0.00179	0.00111	Hardness = 36 mg/l
Auburn Ravine	Sutter County	06/06/01	0.000008	0.00247	0.00113	Hardness = 27 mg/l
Auburn Ravine	Sutter County	07/17/01	0.000018	0.00297	0.00388	Hardness = 27 mg/l
Auburn Ravine	Sutter County	08/02/01	0.000008	0.00177	0.00151	Hardness = 29 mg/l
Auburn Ravine	Sutter County	09/06/01	0.000006	0.00188	0.00088	Hardness = 25 mg/l
Auburn Ravine	Sutter County	10/11/01	0.000010	0.00293	0.00200	Hardness = 43 mg/l
Auburn Ravine	Sutter County	10/31/01	0.000038	**0.00525**	0.00624	Hardness = 59 mg/l
Auburn Ravine	Sutter County	12/21/01	0.000146	**0.01970**	0.02900	Hardness = 46 mg/l
Cross Canal	Sutter County	01/25/01	0.000039	0.00445	0.00555	Hardness = 65 mg/l
Cross Canal	Sutter County	03/01/01	0.000052	**0.01100**	0.0102	Hardness = 72 mg/l
Cross Canal	Sutter County	04/05/01	0.000014	0.00299	0.00301	Hardness = 46 mg/l
Cross Canal	Sutter County	05/03/01	0.000015	0.00298	0.0019	Hardness = 46 mg/l
Cross Canal	Sutter County	06/06/01	0.000023	0.00214	0.00113	Hardness = 52 mg/l
Cross Canal	Sutter County	07/17/01	No Flow	No Flow	No Flow	No Flow
Cross Canal	Sutter County	08/02/01	0.000015	0.00278	0.00291	Hardness = 59 mg/l
Cross Canal	Sutter County	09/06/01	0.000014	0.00302	0.0026	Hardness = 70 mg/l
Cross Canal	Sutter County	10/11/01	0.000013	0.00343	0.00236	Hardness = 65 mg/l
Cross Canal	Sutter County	10/31/01	0.000015	0.00354	0.00228	Hardness = 63 mg/l

Cross Canal	Sutter County	12/21/01	0.000098	**0.0117**	0.0158	Hardness = 58 mg/l

* Values in bold exceed California Toxics Rule objectives for aquatic life at a hardness of 50 mg/l.

Sources: California Toxics Rule (water quality objectives); Department of Water Resources unpublished data.

APPENDIX AUBURN RAVINE 2

Auburn Ravine Selected Water Quality Monitoring Data
Near the City of Auburn's Wastewater Treatment Plant
1995 Monitoring Results

1995 Monitoring Results for Selected Parameters from Auburn Ravine. Location R-1 is just upstream of the City of Auburn's Wastewater Treatment Plant Discharge. Location R-4 is Downstream of the Discharge in the Mixing Zone.

Parameter	Location	Frequency	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Dissolved Oxygen	R-1	Mean Monthly	mg/l	11.1	12.1	9.8	11.3	11.1	11.4	10.9	10.6	9.8	10	10.7	11.7
	R-4	Single Sample	mg/l	11.09				10.5				9.78	9.25		
Temperature	R-1	Mean Monthly	^{O}C	8.7	6.4	7.5	9	9.8	11	12.3	14.3	15.9	14.56	11.9	10.1
	R-4	Single Sample	^{O}C	8.6				13				17.9	18.3		
pH	R-1	Mean Monthly	units	7.4	7.2	5.7	7.3	7.3	7.2	7	7.1	7	7.4	7.2	7.3
	R-4	Single Sample	units	9.4				6.6				7.14	7.73		
Nitrate	R-1	Mean Monthly	mg/l	2				<0.50				<0.50	3.6		
	R-4	Single Sample	mg/l	3				<0.50				1.8	3.7		
Total Phosphorus	R-1	Mean Monthly	mg/l	<0.05				<0.02				<0.02	0.04		
	R-4	Single Sample	mg/l	0.08				0.09				0.19	0.51		
Hardness	R-1	Mean Monthly	mg/l	36				23				20	61		
	R-4	Single Sample	mg/l	43				24				14	71		

Source: FEIR for the Auburn Wastewater Facility Plan, 1997; Adapted from Table 3-9.

APPENDIX AUBURN RAVINE 3

BENTHIC MACROINVERTEBRATE DATA
COLLECTED BY THE AUBURN RAVINE CITIZENS GROUP

PHYLUM / Class / Order / Family / *Genus species*	TV[1]	FFG[2]	Mar-00 Auburn Ravine @ Joiner Parkway				Mar-00 Auburn Ravine @ Moore Road			Sep-01 Auburn Ravine @ Joiner Parkway		
ARTHROPODA												
Hexapoda												
Coleoptera (Larvae)												
Elmidae	5	cg										
Psephenidae	4	sc										
Diptera												
Chironomidae	6	cg	33	2	85	3	54	17	3	19	37	36
Empididae	6	p			3							
Simuliidae	6	cf								20		3
Tipulidae	3	sh										
Ephemeroptera												
Baetidae	4	cg			6		7	4	3	19	18	40
Ephemerellidae	1	cg						2	1			
Leptohyphidae	4	cg			1					3	5	4
Plecoptera												
Capniidae	1	sh										
Chloroperlidae	1	p	2	2	4	2	7	20	22	1	4	
Perlodidae	2	p					1	8				
Trichoptera												
Brachycentridae	1	ot										
Glossosomatidae	0	sc	1								1	
Hydropsychidae	4	cf					1	1	1	1		
Hydroptilidae	4	ot										
Leptoceridae	4	ot									4	
Philopotamidae	3	cf								1		
Lepidostoma												
Pyralidae	5	sc									1	
Odonata												
Coenagrionidae	9	p										
Gomphidae	4	p								2	1	
Libellulidae	9	p	1							2		1
Subphylum Chelicerata												
Arachnoidea												
Hydracarina (=Acari)	5	p			1		1	2	1	2	4	5
Subphylum Crustacea												
Malacostraca												
Amphipoda	4	cg									1	2
MOLLUSCA												
Gastropoda												

Limnophila												
Planorbidae	6	sc									1	
Bivalvia												
Pelecypoda												
Corbiculacea	10	cf								1		
NEMATODA	5	p										
NEMERTEA												
PLATYHELMINTHES												
Turbellaria												
Tricladida												
Planariidae	4	p										
ANNELIDA												
Oligochaeta	5	cg					1		2	11	5	5
Total Macroinvertebrates:			37	4	100	5	72	54	33	82	82	96
[1] TV: Tolerance Values												
[2] FFG: Functional Feeding Groups												
Taxonomic Richness			4	2	6	2	7	7	7	12	12	8
EPT Taxa			2	1	3	1	4	5	4	5	5	2
Ephemeroptera Taxa			0	0	2	0	1	2	2	2	2	2
Plecoptera Taxa			1	1	1	1	2	2	1	1	1	0
Trichoptera Taxa			1	0	0	0	1	1	1	2	2	0
EPT Index			8	50	11	40	22	65	82	30	39	46
Sensitive EPT Index			8	50	4	40	11	56	70	2	6	0
Tolerance Value			5.6	3.5	5.7	4.0	5.2	3.1	2.2	5.3	4.9	5.0
Percent Intolerant Organisms			8	50	4	40	11	56	70	2	6	0
Percent Tolerant Organisms			2.7	0.0	0.0	0.0	0.0	0.0	0.0	3.7	0.0	1.0
Percent Dominant Taxon			89	50	85	60	75	37	67	24	45	42
Percent Collectors			89	50	92	60	86	43	27	63	80	91
Percent Filterers			0	0	0	0	1	2	3	28	0	3
Percent Grazers			3	0	0	0	0	0	0	0	4	0
Percent Predators			8	50	8	40	13	56	70	9	11	6
Percent Shredders			0	0	0	0	0	0	0	0	0	0
Other			0	0	0	0	0	0	0	0	5	0
		03/01/00			03/01/00			09/01/01				
		Auburn Ravine			Auburn Ravine @			Auburn Ravine @				

	@ Joiner Parkway *			Moore Road			Joiner Parkway		
	Mean	SE	CST	Mean	SE	CST	Mean	SE	CST
Taxonomic Richness	4	1.0	8	7	0.0	8	11	1.3	17
EPT Taxa	2	0.5	4	4	0.3	5	4	1.0	7
Ephemeroptera Taxa	1	0.5	2	2	0.3	2	2	0.0	2
Plecoptera Taxa	1	0.0	1	2	0.3	2	1	0.3	1
Trichoptera Taxa	0	0.3	1	1	0.0	1	1	0.7	4
EPT Index (%)	27	10	12	56	18	49	38	4.4	39
Sensitive EPT Index (%)	26	11	8	45	18	38	3	1.8	3
Dominant Taxon (%)	71	9.5	84	60	12	47	37	6.4	35
Tolerance Value	4.7	0.6	5.5	3.5	0.9	3.9	5.0	0.1	5.0
Intolerant Organisms (%)	26	11	8	45	18	38	3	1.8	3
Tolerant Organisms (%)	0.7	0.7	0.7	0.0	0.0	0.0	1.6	1.1	1.5
Collectors (%)	73	10	89	52	18	59	78	7.9	79
Filterers (%)	0	0.0	0	2	0.5	2	10	8.9	10
Grazers (%)	1	0.7	1	0	0.0	0	1	1.2	1
Predators (%)	27	11	10	46	17	39	9	1.4	8
Shredders (%)	0	0.0	0	0	0.0	0	0	0.0	0
Other (%)	0	0.0	0	0	0.0	0	2	1.6	2

* Site statistics based on small and variable sample sizes

BEAR RIVER

A. Water Quality Data

No data are currently available. A report prepared for the South Sutter Water District may contain water quality information. The report may be available for public distribution in late-December 2003.

B. Water Temperature Data

1. Water Temperature Information from Bailey Environmental Late-May 2003 to August 2003: Bailey Environmental began a water temperature monitoring program for Placer County beginning in May 2003. The early results from this sampling program are presented in Figures 1 and 2 below. Figure 1 displays data from a site located at the upstream boundary of the Patterson Sand and Gravel operation, approximately 2,000 feet downstream of the South Sutter irrigation diversion dam below Camp Far West Reservoir. Figure 2 displays data from a site located at the downstream boundary of the Patterson Sand and Gravel operation. **Source: Bailey Environmental, unpublished data.**

Figure 1. Water temperature time series from the upper Patterson Sand and Gravel site on the Bear River for the period May 28 to August 4, 2003. Conditions appear to be suitable for juvenile rearing.

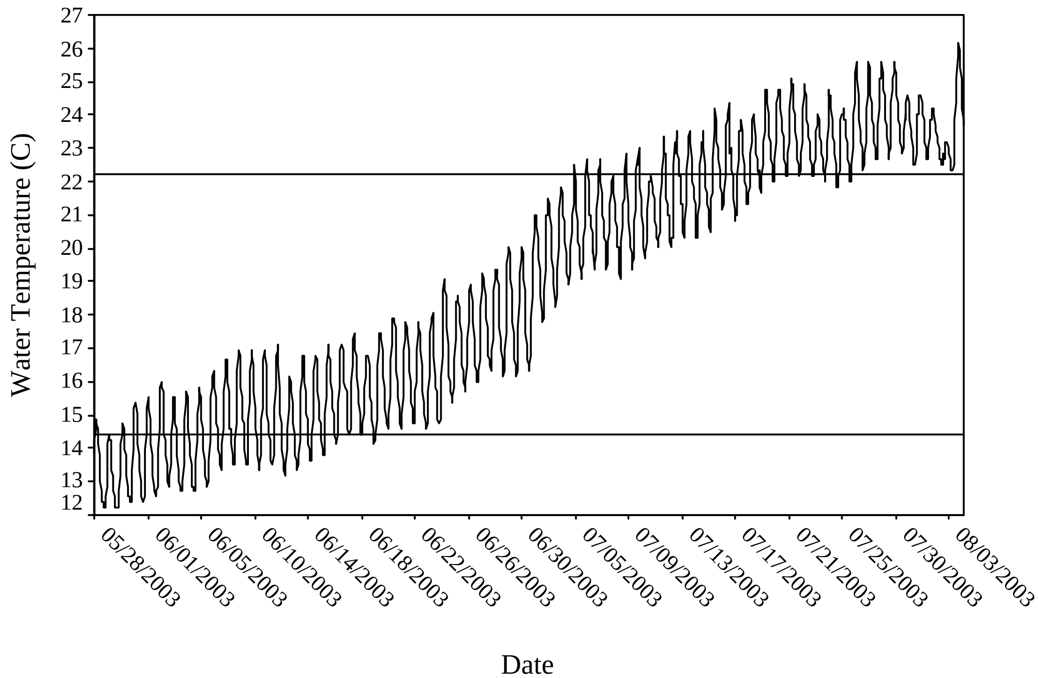
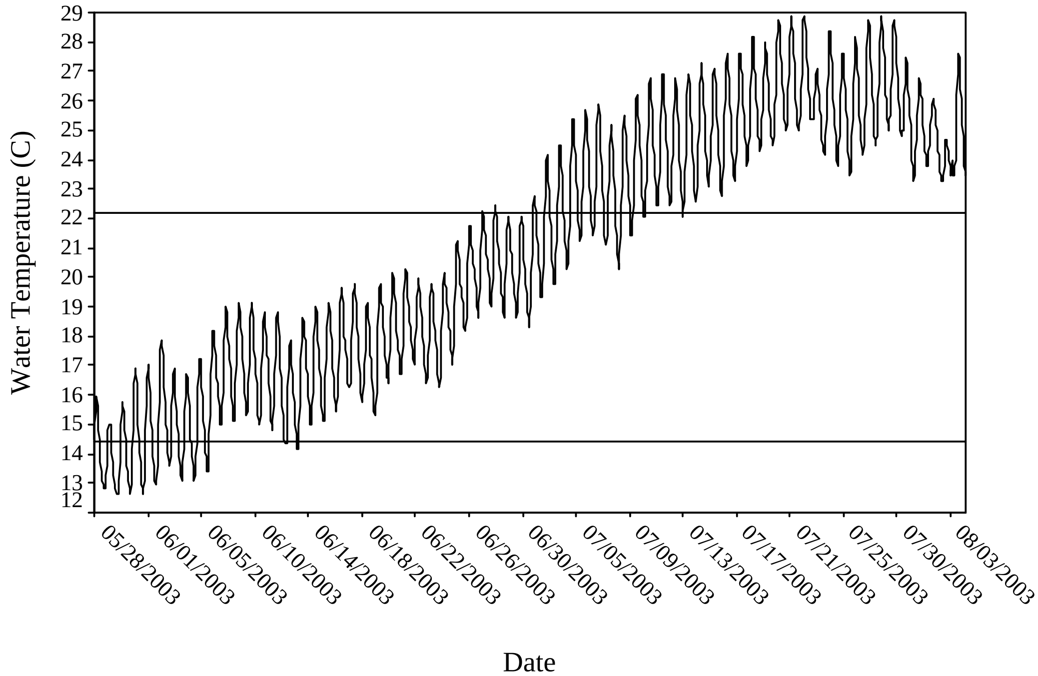


Figure 2. Water temperature time series from the lower Patterson Sand and Gravel site on the Bear River for the period May 28 to August 4, 2003. Conditions do not appear to be suitable for juvenile rearing.



C. **Benthic Invertebrate Data**

No data are currently available. A report prepared for the South Sutter Water District may contain water quality information. The report may be available for public distribution in late-December 2003.

D. **Physical Habitat Data**

No data are currently available. A report prepared for the South Sutter Water District may contain physical habitat information. The report may be available for public distribution in late-December 2003.

E. **Fishery Resource Data**

While no fishery resource data is currently available, fall-run chinook salmon are present in the system and do spawn downstream of Camp Far West Reservoir. There is some anecdotal evidence of spawning but no reliable estimates of run size. A report prepared for the South Sutter Water District may contain fishery resource information. The report may be available for public distribution in late-December 2003.

F. **Fish Passage or Screening Data**

No data are currently available. A report prepared for the South Sutter Water District may contain fish passage or screening information. The report may be available for public distribution in late-December 2003.

COON CREEK

A. Water Quality Data

1. Lincoln High School Water Quality Monitoring: Mark Fowler and Lee Beckman provided the following water quality data from the Lincoln High School sampling program, which was jointly funded by NID, Placer County, and the City of Lincoln. While the data are limited, two parameters are of concern from a stream ecology standpoint. First, the dissolved oxygen concentrations reported show supersaturated levels of approximately 150%, which is unusual for lower gradient streams; these data may be unreliable due to methodological problems. Second, the concentrations of nitrate reported are high for a fall reading and could indicate eutrophication of the stream, particularly during the summer months. Without data on orthophospate for comparison, it is impossible to determine if nitrates are limiting biostimulation of algal growth and potentially causing diurnal dissolved oxygen fluctuations during the nighttime hours. Excessive algal growth has been observed in Coon Creek during the summer at these locations. **Source: Lincoln High School Water Quality Monitoring, unpublished data.**

Table 1. Coon Creek water quality data 2002

Parameter	Tahti Property	Fleming Property
Date	10/6/2002	11/17/2002
Time	0955	1115
Air Temperature (^{O}F)	--	61
Water Temperature (^{O}F)	63	52
Weather	Clear	Clear
Stream Flow (cfs)	0.9	3.3
pH	7.35	7.3
Dissolved Oxygen (mg/l)	16.5	16.5
Electrical Conductivity (µs/cm)	97.4	166.5
Color (color units)	14	50
Nitrates (mg/l)	1.1	3.6
Chlorides (mg/l)	0.04	0.04
Total Coliform (MPN/100ml)	93	150
Fecal Coliform (MPN/100ml)	240	43

Source: Lincoln High School Water Quality Monitoring, unpublished data.

2. Auburn Ravine/Coon Creek Ecosystem Restoration Plan: This plan, published by the County of Placer, contains preliminary data on heavy metals and a number of other constituents. This data were collected on Auburn Ravine, Coon Creek, and in the Eastside Canal (the actual sampling location is actually just upstream of the Cross Canal, even though the data location is labeled Cross Canal). The County is already in possession of this data in electronic format and therefore it is not repeated here. However, the data for cadmium, copper, and zinc are presented in Appendix Coon Creek 1 because all of these metals at some times of the year exceed California Toxic Rule objectives for aquatic life. In Coon Creek, the only metal that exceeds the standards at 50 mg/l hardness is copper. The other metals are included because their standards are exceeded in other streams in the western portion of the County. **Source: California Toxics Rule and Department of Water Resources unpublished data.**

3. FEIR Teichert Aggregate Facility: In the final EIR for this project, Table 13-2 displays surface water quality data for several sites that were sampled once in January 1994. The sites are labeled as W-4, W-5, W-7, and W-8 on Revised Figure 13-6 in the document and correspond to sites in the center of the project area, upstream of the project area but just downstream of Gladding Road, a site just upstream of Gladding Road on the south channel, and a site just upstream of Gladding Road on the north channel, respectively. In general, the water quality parameters measured fall within an expected and acceptable range for anadromous fish streams. However, some of the detection limits used in the analysis preclude an assessment of whether or not certain constituents meet the water quality standards established in the California Toxics Rule. Table 2 displays some pertinent constituents and the applicable standards. **Source: FEIR Teichert Aggregate Facility 2000, Placer County Planning Dept.**

Table 2. Selected water quality constituents from the Teichert Project Site and immediate upstream locations, based on a single sample in January 1994. California Toxic Rule standards are based on a hardness of 100 mg/l as $CaCO_3$. Hardness values less than 100 reduce the acceptable concentration of each applicable standard accordingly.

Constituent	Maximum Concentration (Acute) mg/l	Continuous Concentration (Chronic) mg/l	W-4 mg/l	W-5 mg/l	W-7 mg/l	W-8 mg/l
Hardness	--	--	88	88	85	100
pH			7.6	7.8	7.7	7.5
Silver	0.0034	--	<0.010	<0.010	<0.010	<0.010
Cadmium	0.0043	0.0022	<0.010	<0.010	<0.010	<0.010
Copper	0.0013	0.0090	<0.050	<0.050	<0.050	<0.050
Lead	0.065	0.0025	<0.010	<0.010	<0.010	<0.010

Source: FEIR Teichert Aggregate Facility; California Toxics Rule.

4. NPDES Monitoring Data from Placer County's Wastewater Treatment Plant (SMD #1): Placer County operates this treatment plant and discharges the effluent into Rock Creek immediately upstream of its confluence with Dry Creek. Dry Creek converges with Orr Creek a short distance downstream to become Coon Creek. Approximately 20 years of monitoring data are available. I have included some selected data, (collected in 2001) from the monitoring station designated as R-4, which is in the mixing zone downstream in Dry Creek, to illustrate several points. This source of flow has a definitive effect on the water quality of Coon Creek. While the NPDES monitoring requirements do not require measurement of nitrate levels, this discharge is a major contributor of nitrogen loading in the stream. Floating mats of algae and attached aquatic plants are evident many miles downstream from the discharge. Also, the pH data for the year 2001 (Figure 2) illustrates the rapid fluctuations in values that are being recorded in other streams in western Placer County. Finally, adult fish passage in Coon Creek is almost completely blocked by a barrier in the canyon area of the stream, upstream of Garden Bar Road and downstream of Bell Road. However, there is some anecdotal evidence from local residents, who have occasionally observed salmon and steelhead in Dry Creek. Review of the video taken of this section of the stream shows that the physical habitat conditions appear to be suitable for salmon and steelhead spawning and rearing on at least an intermittent to annual basis if fish passage were provided over the waterfalls and cascades in the canyon area. Under high flow conditions, fish passage is probably suitable for some percentage of the population. The question is whether the water quality and water temperatures in this section are suitable to justify the investment in a passage program. Water temperature data is presented in the water temperature section of this report. **Source: NPDES Monitoring Data from Placer County's Wastewater Treatment Plant (SMD #1), unpublished data.**

Figure 1. Dissolved oxygen concentrations from NPDES monitoring station R-4, Dry Creek/Coon Creek, during 2001. These data show that dissolved oxygen levels are adequate to support anadromous fish spawning and rearing. The reference at 7 mg/l is considered a minimum optimum level, but salmonids will handle concentrations as low a 5 mg/l.

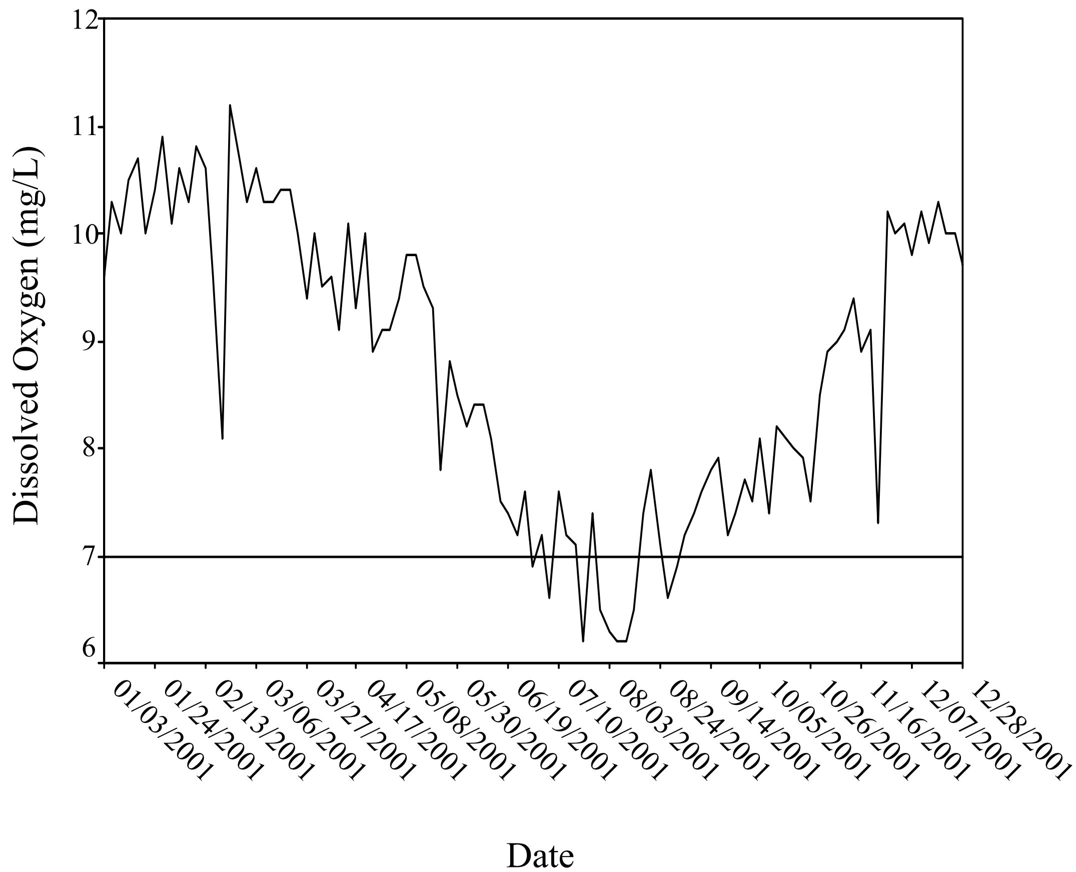
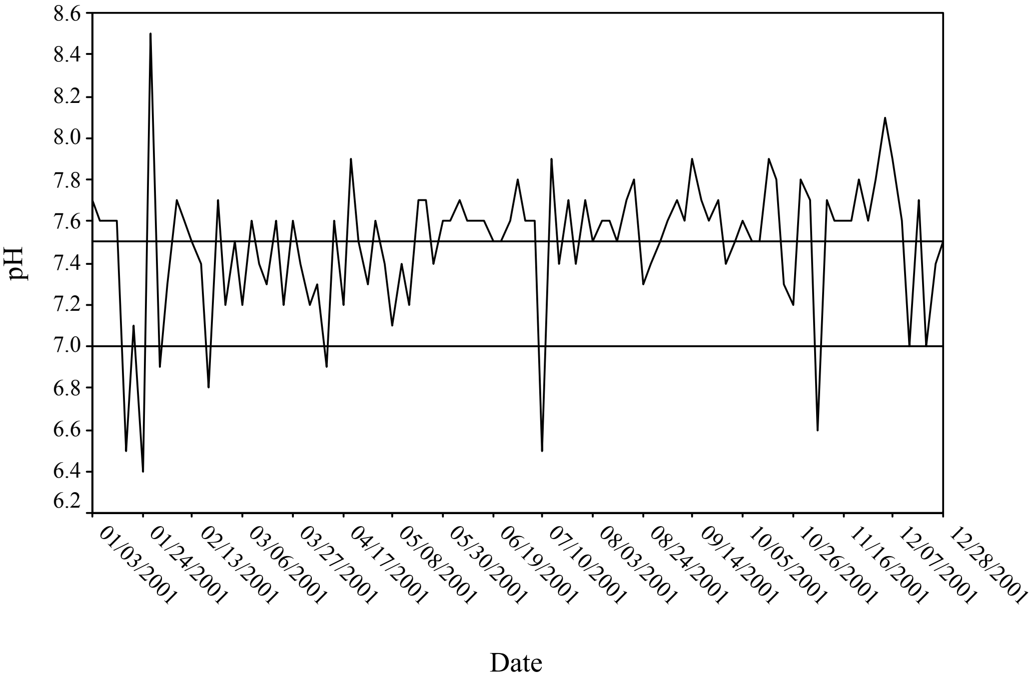


Figure 2. pH values from NPDES monitoring station R-4, Dry Creek/Coon Creek, during 2001. The rapid rate and magnitude of changes are unexplained at this time. Finding the cause the rate and magnitude of changes is essential before any decisions regarding fish passage over the canyon area obstacles are made.



B. <u>Water Temperature Data</u>

Water temperature data were extracted from various one-time fish sampling projects conducted by the CDFG and are presented below. Most of the available data comes from monitoring conducted by Bailey Environmental and includes hourly readings. Due to limitations in the statistical package, only 3,000 temperature data points can be displayed in a single time series plot. Since daily maximum, minimum, and/or mean temperatures individually are of little value, I have chosen to plot all data points. Therefore, I have split the year into time periods that roughly correspond to:

Fall-early winter: September though December; primary fall-run chinook spawning period is November-December.
Winter-spring: January though April; fall-run chinook incubation and rearing and steelhead spawning, incubation, and rearing.
Late spring-summer: May to September; summer rearing for steelhead juveniles.

Data plots for these time periods are presented below to allow the reader to assess the potential of Coon Creek to support chinook salmon and/or steelhead trout spawning and rearing. A variety of localized data and literature was reviewed, in order to get some generalized understanding of the temperature effects on various life history stages for both chinook salmon and steelhead trout. There is fairly substantial variation in temperature effects noted for most life history stages. However, both chinook salmon and steelhead are have a highly adaptable physiology and ability to seek thermal refuge during part of the day which allows them to tolerate and/or avoid lethal temperatures. Some of the literature sources cite criteria reported by others and some of the data is based on fish captures with water temperature taken concurrently. Two tables with data and reference are included in Appendix A of this report. Based on this review, the following criteria have been used to indicate what life history stages a particular stream may support at any given time:

Chinook Salmon	**^{O}C**	**Steelhead Trout**	**^{O}C**
Egg and fry development	14.4 (58 ^{O}F)	Egg and fry development	14.4 (58 ^{O}F)
Juvenile rearing	21.1 (70 ^{O}F)	Juvenile rearing	22.2 (72 ^{O}F)
Adult migration	21.7 (71 ^{O}F)	Adult migration and holding	22.2 (72 ^{O}F)

Reference lines at 14.4 ^{O}C and 22.2 ^{O}C have been placed on Figures 3-17, as appropriate, to roughly represent the water temperatures suitable for salmonid spawning migration, egg and fry development, and juvenile rearing.

1. Spring 1965 Fall-run Chinook Salmon Juvenile Emigration Survey by Eric Gerstung: The following water temperature data were reported in this survey. **Source: Hand written draft of May 25, 1965 memorandum in CDFG, Region 2 files.**

Date	Time	Temp. (^{O}F)	Location
3/8/65	1055	56	South channel, 100 yards upstream of Gladding Rd.
3/15/65	1315	59	South channel, 100 yards upstream of Gladding Rd.
3/8/65	1105	57	North channel, 100 yards upstream of Gladding Rd.
3/15/65	1330	58	North channel, 100 yards upstream of Gladding Rd.
3/17/65	1115	54	North channel, 100 yards upstream of Gladding Rd.

Source: Hand written draft of May25, 1965 memorandum in CDFG, Region 2 files.

2. 1984 Seining and Electrofishing for Native Brood Year 1983 Fall-run Chinook Salmon. Source: unsigned, unidentifiable author note in CDGFG, Region 2 files.

Date	Time	Water Temp. (^{O}F)	Location
2/28/84	--	--	McCourtney Road
2/28/84	1030	46	Highway 65
3/27/84	1000	67	McCourtney Road
3/27/84	0900	67	Highway 65
5/2/84	1100	53	McCourtney Road
5/2/84	0900	60	Highway 65
5/24/84	--	70	Highway 65

Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.

3. Dowd Road Juvenile Trapping Survey May 9-17, 1992: This data is from a short-term juvenile chinook salmon trapping program on Coon Creek. The trapping location was located approximately 100 yards downstream of Dowd Road. **Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.**

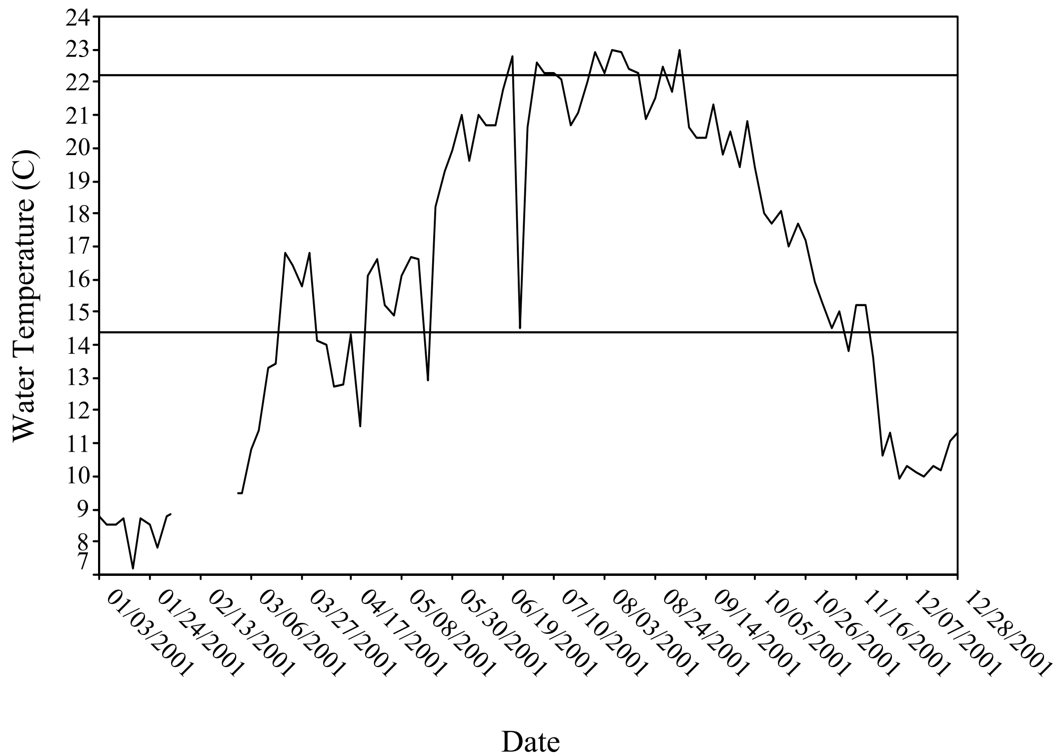
Date	Time	Water Temp. (^{O}F)	Location
5/10/92	0850	65	100 yards downstream of Dowd Rd.
5/11/92	0630	62	100 yards downstream of Dowd Rd.
5/12/92	0630	63	100 yards downstream of Dowd Rd.
5/13/92	0600	66	100 yards downstream of Dowd Rd.
5/14/92	0600	64	100 yards downstream of Dowd Rd.
5/15/92	0700	60	100 yards downstream of Dowd Rd.
5/16/92	0630	65	100 yards downstream of Dowd Rd.
5/17/92	0620	65	100 yards downstream of Dowd Rd.

Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.

4. Department of Fish and Game One-Time Seining Event: CDFG conducted a one-day fish sampling on Coon Creek just upstream of Highway 65 on April 5, 1983. Water temperature was recorded as 54 ^{O}F at 0845. **Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.**

5. NPDES Monitoring Data from Placer County's Wastewater Treatment Plant (SMD #1): Water temperatures are monitored routinely as a condition of the County's NPDES permit requirements. Figure 3 shows data from calendar year 2001. Approximately 20 years of data are available. I chose only station R-4 to highlight because it is the station at the downstream mixing zone of the discharge and represents the most likely water temperatures that would be present in Coon Creek at its beginning. **Source: NPDES Monitoring Data from Placer County's Wastewater Treatment Plant (SMD #1), unpublished data.**

Figure 3. Water temperatures from NPDES monitoring station R-4, Dry Creek/Coon Creek, during 2001. These data show that temperatures in this year were adequate to support anadromous fish spawning and rearing.



6. FEIR Teichert Aggregate Facility: Limited data on water temperatures from the site are presented in the FEIR. However, Warren Shaul of Jones and Stokes has stated that they now have 4 years of data. This data is already presumed to be in the County's possession and is not presented in this report. **Source: FEIR Teichert Aggregate Facility 2000, Placer County Planning Dept. and Warren Shaul, Jones and Stokes, pers. comm.**

7. Water Temperature Information from Bailey Environmental September 2001 to August 2003: Figures 4-8 display water temperatures recorded at the Foggy Ranch property, just upstream of Garden Bar Road. Monitoring at this station began in September 2001, but the temperature sensor has been stolen once and experienced a major malfunction, so there are gaps in the record. Temperature data has also been collected at the Tahti property, just upstream of Gladding Road during the same time period (Figures 9-14). New stations were established in late-May to early-June 2003 under the County's monitoring program. These stations are located on the Zobel property (Figure 15) in Dry Creek downstream from County wastewater treatment plant (SMD #1), at the Coon Creek Trap Club (Figure 16) near the Sutter County line, and at the Nicolaus Road crossing (Figure 17). All of the data are presented in the body of this report because of the short period of record for most stations. **Source: Bailey Environmental, unpublished data.**

Figure 4. Water temperature time series for Coon Creek at the Foggy Ranch, just upstream of Garden Bar Road, September through December 2001. Data indicate that successful fall-run chinook salmon spawning could have begun in late October/early November 2001 and that conditions were suitable for juvenile rearing.

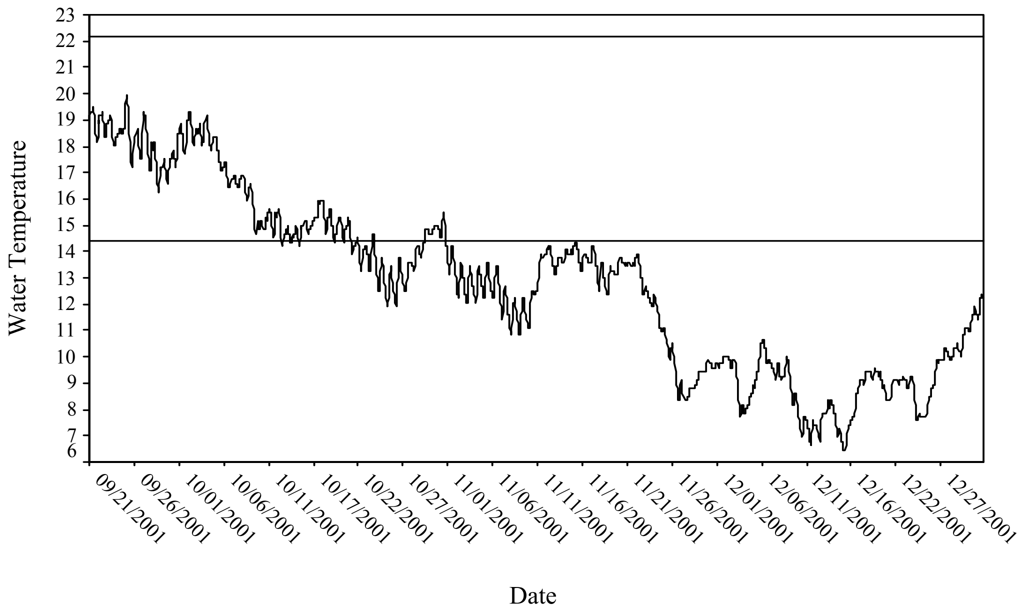


Figure 5. Water temperature time series for Coon Creek at the Foggy Ranch property, just upstream of Garden Bar Road, during the period January through April 2002. Some data are missing because of sensor failure or theft. Temperatures are suitable for egg incubation and juvenile rearing.

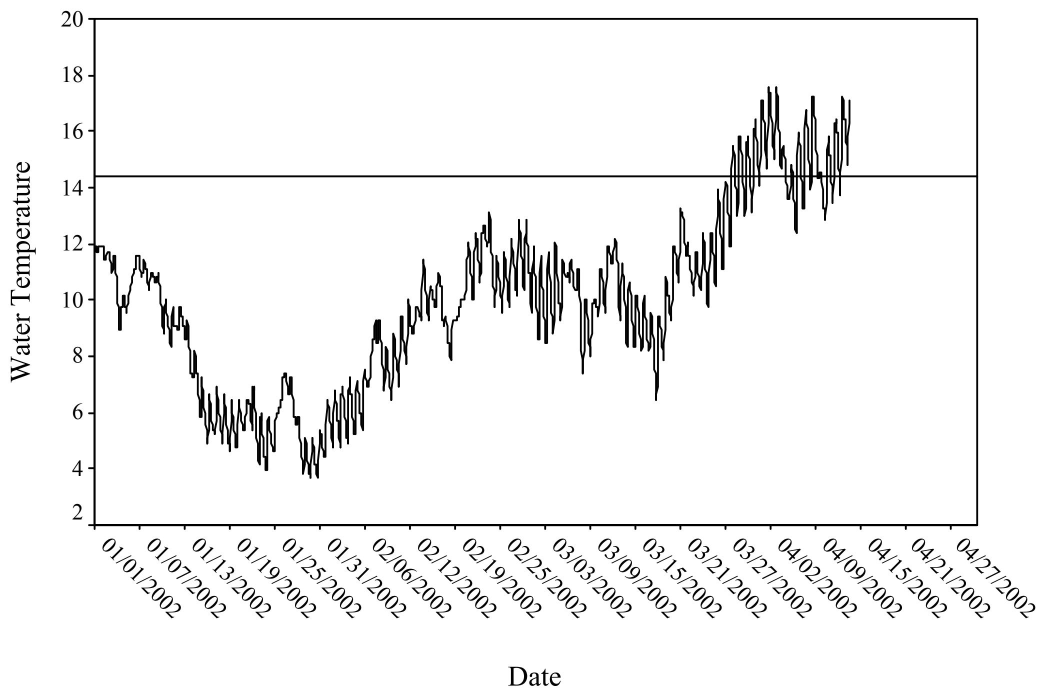


Figure 6. Water temperature time series for Coon Creek at the Foggy Ranch, just upstream of Garden Bar Road, October 22-24, 2002.

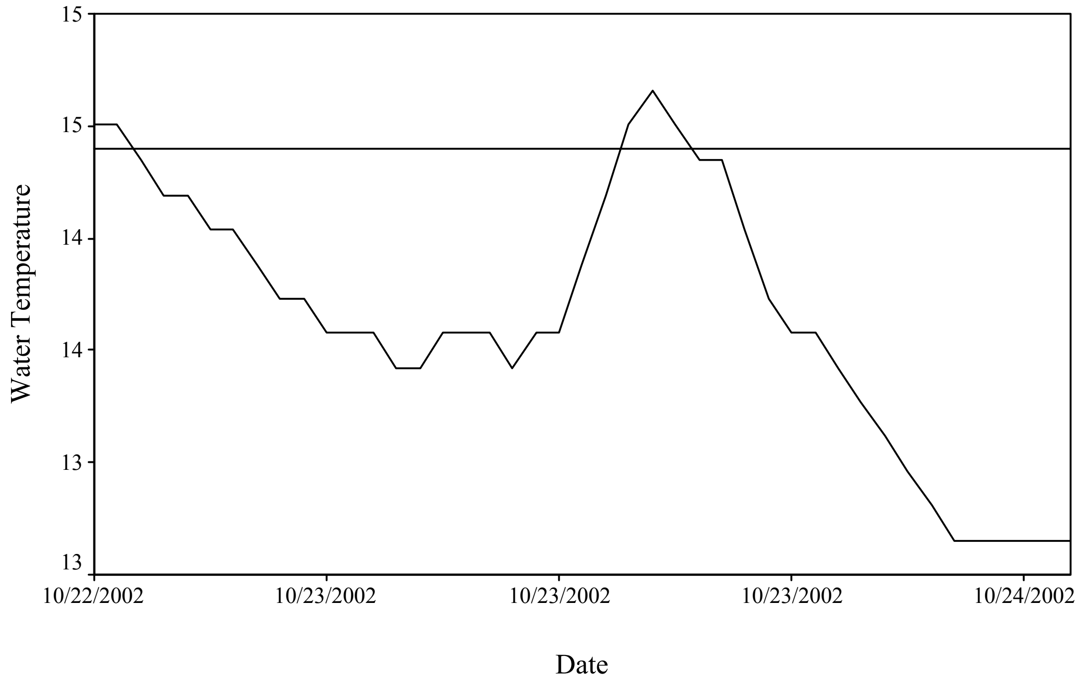


Figure 7. Water temperature time series for Coon Creek at the Foggy Ranch property, just upstream of Garden Bar Road, during the period January through April 2003. Temperatures are suitable for egg incubation and juvenile rearing.

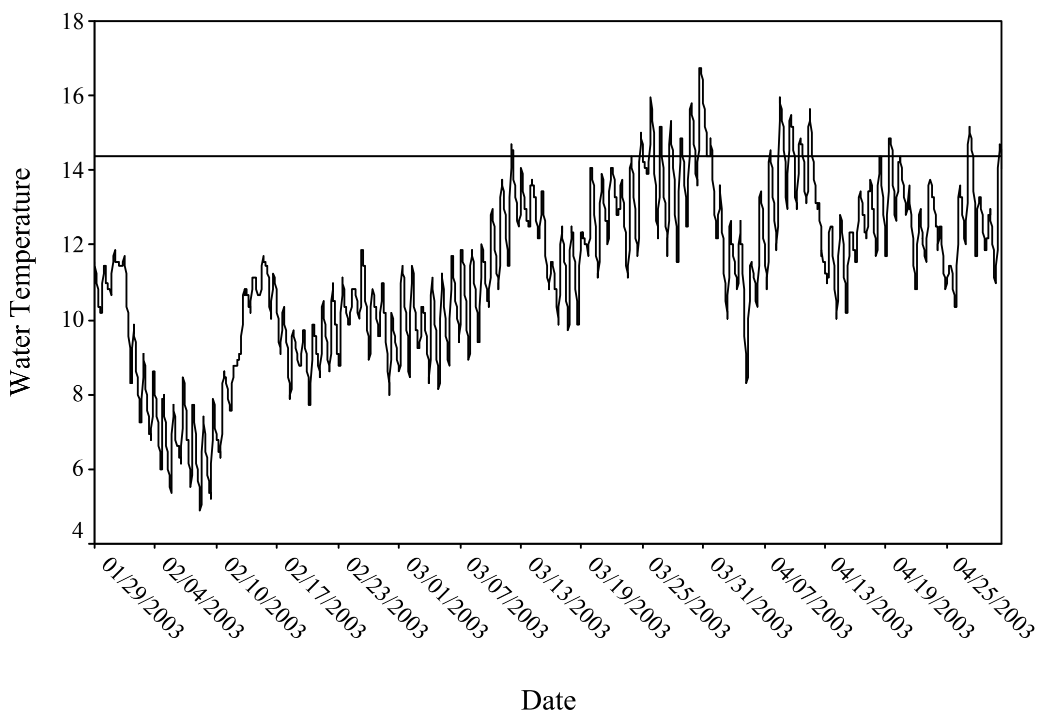


Figure 8. Water temperature time series for Coon Creek at the Foggy Ranch, just upstream of Garden Bar Road, during the period May through August 4, 2003. Temperatures are generally poor for juvenile rearing. This reach would be suitable only if movement to thermal refugia is feasible.

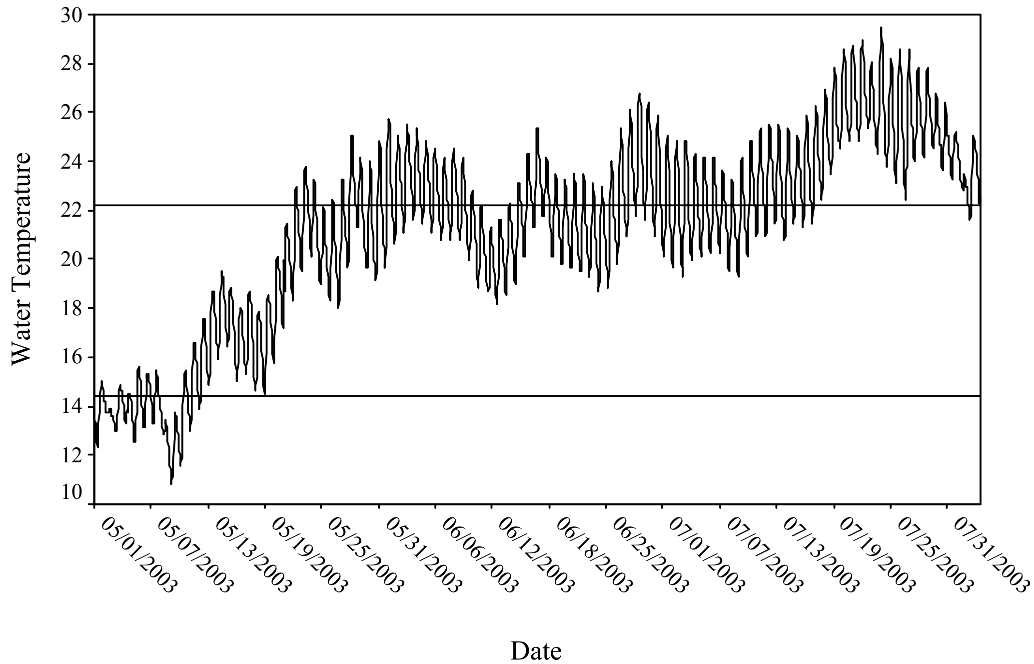


Figure 9. Water temperature time series for Coon Creek at the Tahti property, just upstream of Gladding Road, September through December 2001. These data indicate that successful fall-run chinook salmon spawning could have commenced in late October to early November in 2001 and that conditions were suitable for juvenile rearing.

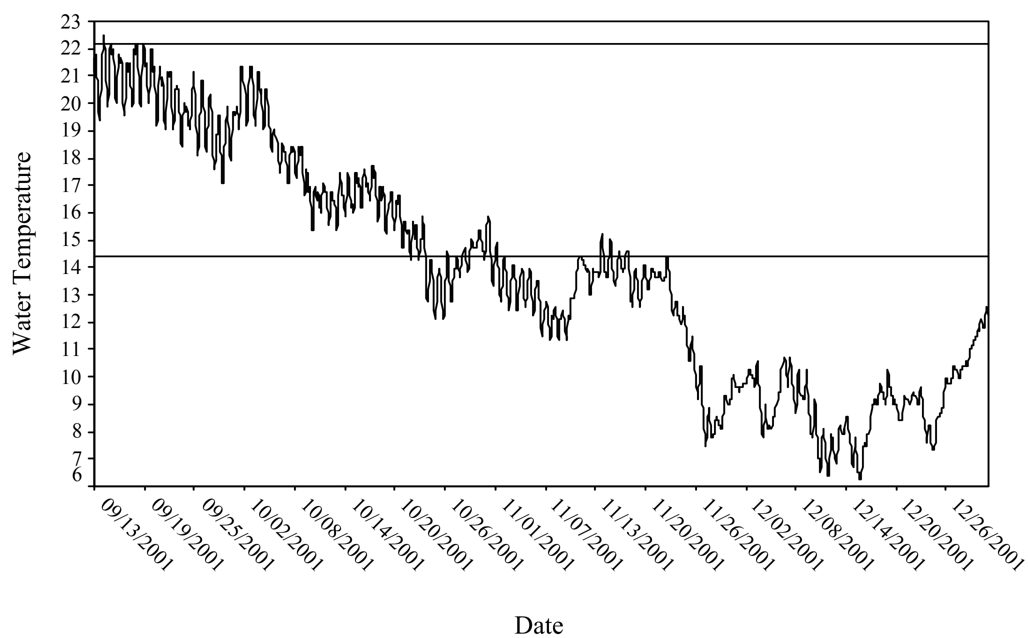


Figure 10. Water temperature time series for Coon Creek at the Tahti property, just upstream of Gladding Road, during the period January through April 2002. Temperatures are suitable for incubation and rearing.

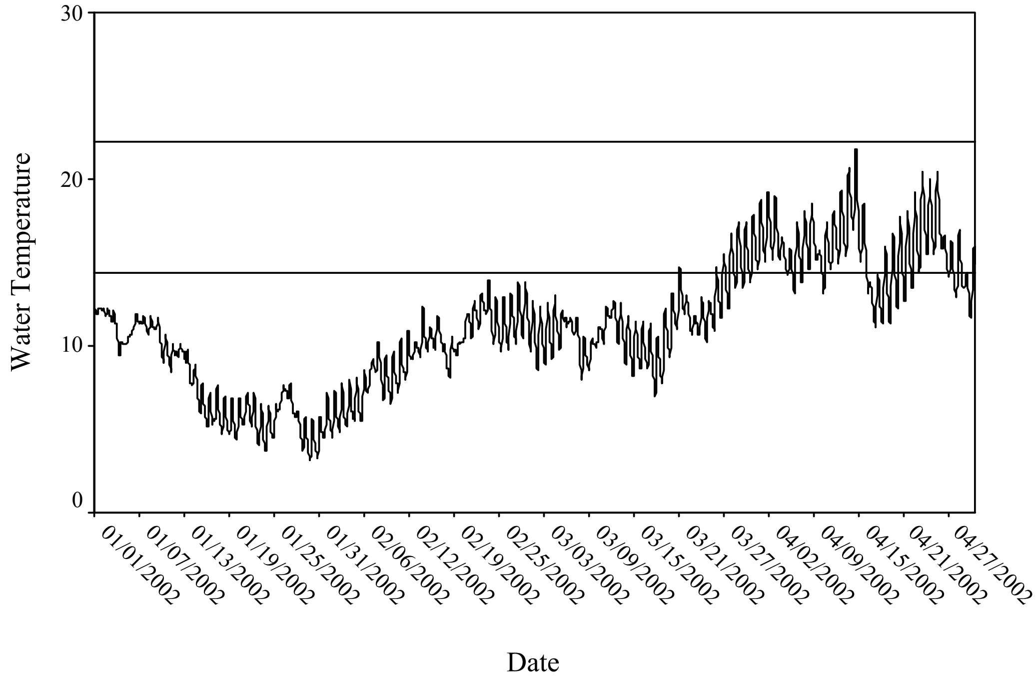


Figure 11. Water temperature time series for Coon Creek at the Tahti property, just upstream of Gladding Road, during the period May through August 2002. Temperatures are marginal to unsuitable for rearing, depending on the availability of thermal refugia.

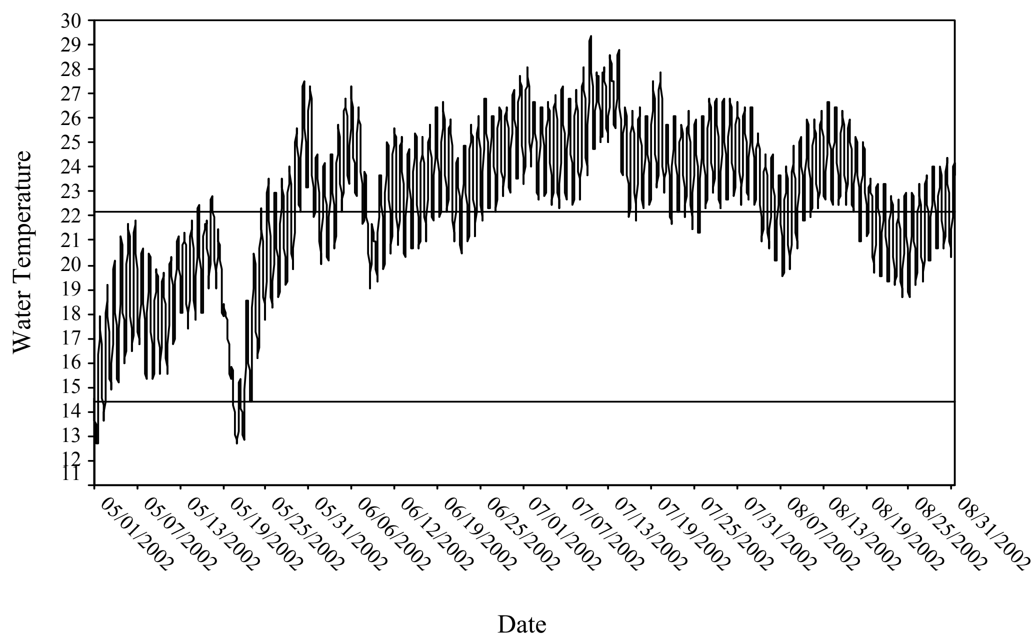


Figure 12. Water temperature time series for Coon Creek at the Tahti property, just upstream of Gladding Road, September through October 22, 2002 (data for October 23 to January 29, 2003 is missing). Successful fall-run chinook salmon spawning could have begun in late October and conditions were suitable for juvenile rearing.

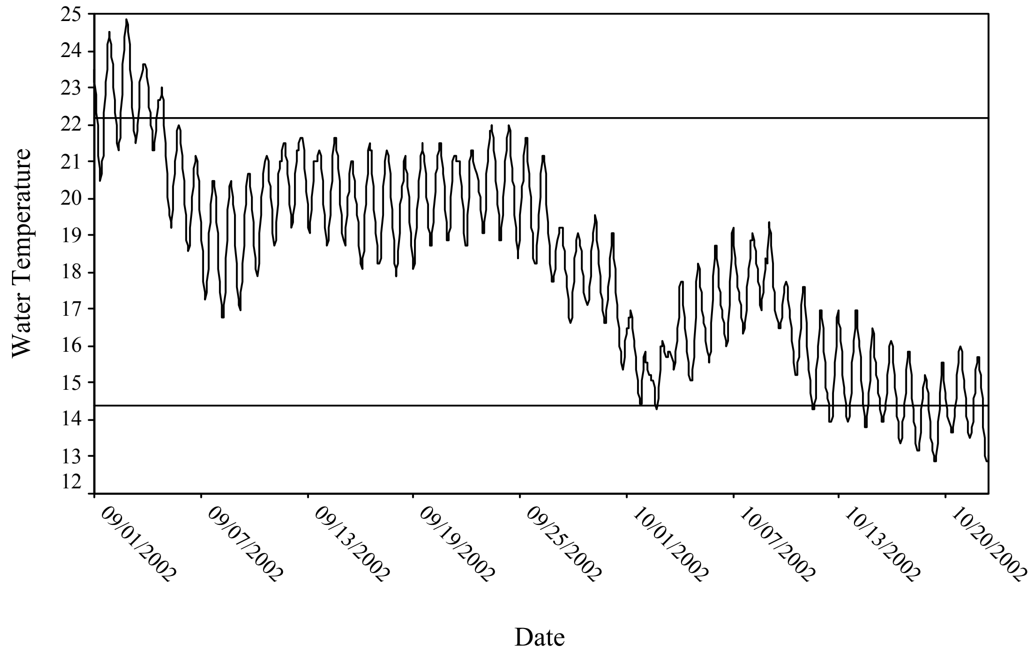


Figure 13. Water temperature time series for Coon Creek at the Tahti property, just upstream of Gladding Road, during the period January through April 2003. Temperatures are suitable for incubation and rearing.

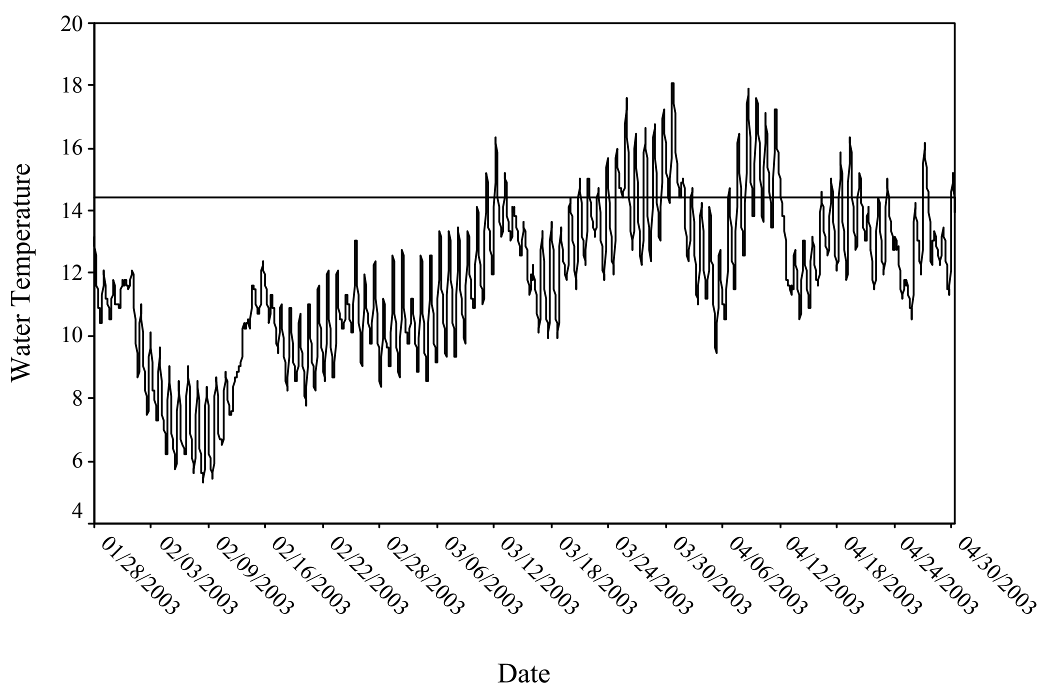


Figure 14. Water temperature time series for Coon Creek at the Tahti property, upstream of Gladding Road, May through August 4, 2003. Temperatures are marginal for juvenile rearing. This reach would be suitable only if movement to thermal refugia is feasible.

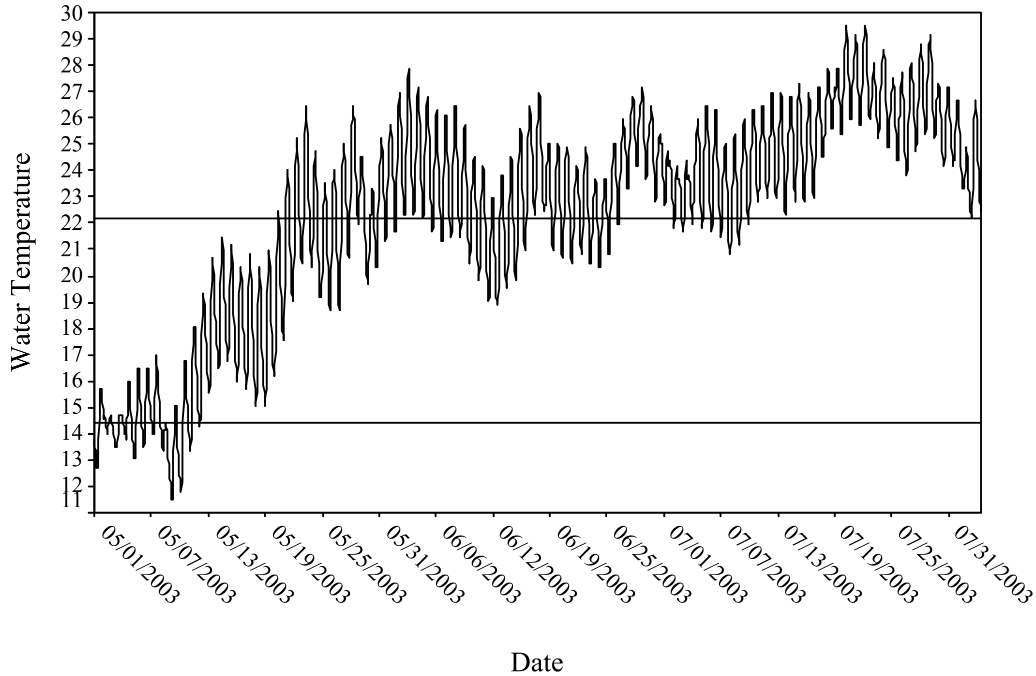


Figure 15. Water temperature time series for Dry Creek/Coon Creek at the Zobel property, June 8 through August 4, 2003. Temperatures are marginal for juvenile rearing. This reach would be suitable only if movement to thermal refugia is feasible.

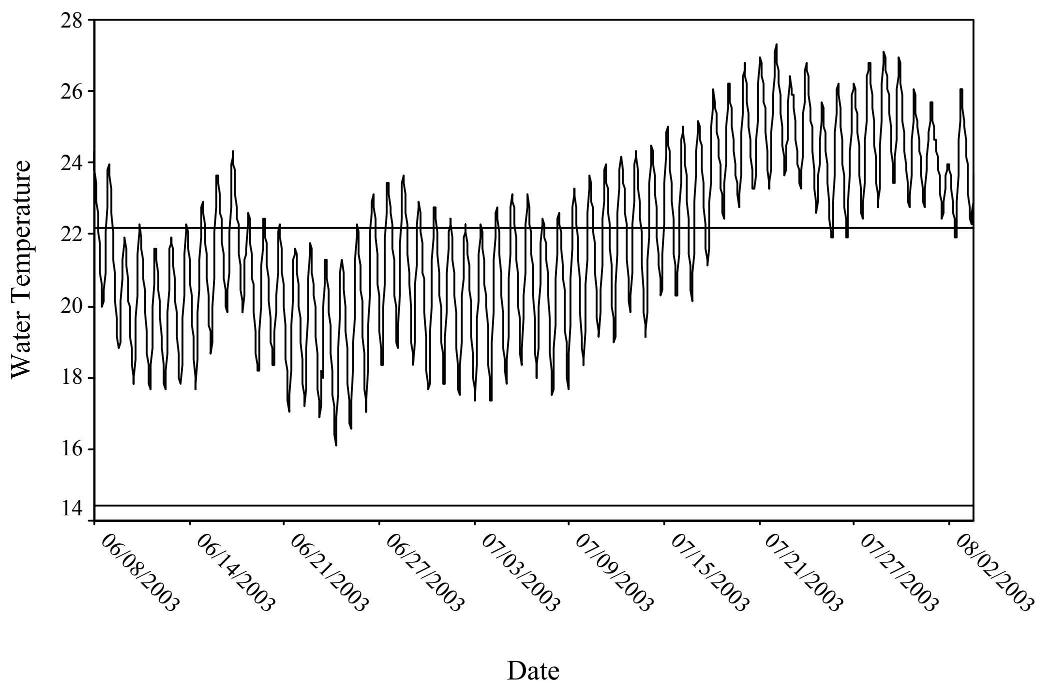


Figure 16. Water temperature time series for the Coon Creek Trap Club, during the period May 28 through August 4, 2003. Temperatures are marginal for juvenile rearing. This reach would be suitable only if movement to thermal refugia is feasible.

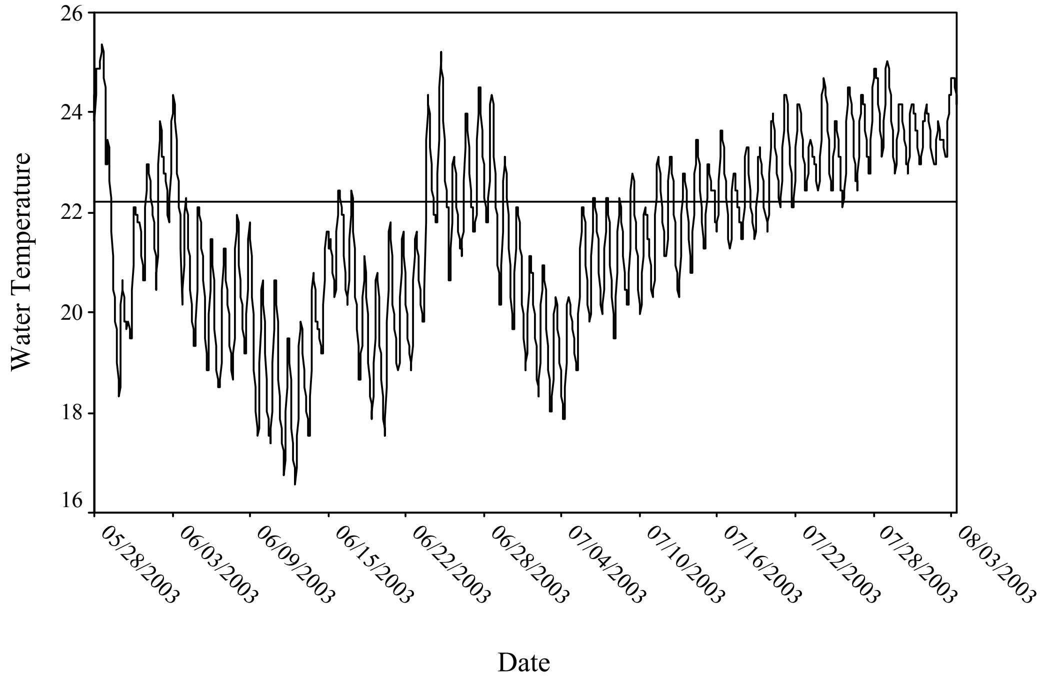
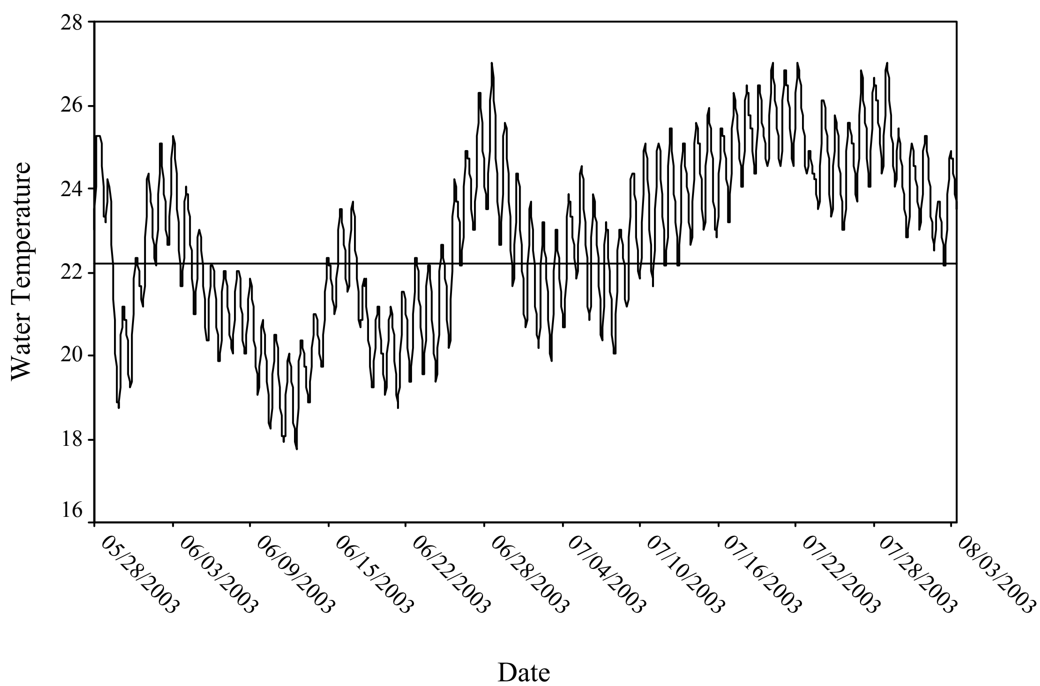


Figure 17. Water temperature time series for Coon Creek at the Nicolaus Road crossing, May 28 through August 4, 2003. Temperatures are marginal for juvenile rearing. This reach would be suitable only if movement to thermal refugia is feasible.



C. Benthic Invertebrate Data

Limited benthic macroinvertebrate data (see Appendix Coon Creek 2 for the complete data set) have been collected from Coon Creek at the Fleming property, downstream of Garden Bar Road. A single sample was collected in December 2000. The data are of limited value. First, samples are collected with equipment that does not readily collect all taxon present in the stream. Second, during the initial sorting, less than 100 individuals were selected for taxonomic identification. This limited sample size raises concerns regarding the representativeness of the data. However, the data do indicate that organisms that are moderately too highly tolerant of water quality impairment dominate the invertebrate community. It is probable that some combination of flow fluctuations, water quality, and the amount of sediment in the stream channel contributes to this general lack of diversity and tendency towards species that are pollution tolerant. **Source: Benthic Macroinvertebrates sampled from Placer County Streams. Prepared for the Auburn Ravine Group by BioAssessment Services, Folsom, CA. December 2002.**

D. Physical Habitat Data

1. April-May 2000 Physical Habitat Survey Conducted by Stacy Li, et. al, for CalSPA: This survey was conducted as part of a court settlement between County of Placer and the California Sportfishing Protection Alliance (CalSPA) regarding Clean Water Act violations at the SMD#1 treatment plant on Joeger Road. The survey area runs from Gladding Road upstream to a large waterfall/cascade on the Spear Ranch property upstream in the canyon above Garden Bar Road. The sampling protocol is based on USDA Forest Service Fish Habitat Relationships program. A list of parameters recorded in the survey is shown below (some variables recorded have not been decoded or interpreted from the field notes). Bailey Environmental is currently the custodian of this data for CalSPA, but data entry and analysis are not complete. Photos were taken of some areas, but they have not been identified to a specific habitat unit. **Source: California Sportfishing Protection Alliance, unpublished data.**

Parameters Recorded	Parameters Recorded	Parameters Recorded
Date Sampled	Water Turbulence Rating	Hydraulic Complexity
Unit Number	Maximum Pool Depth (ft)	Structural Complexity
Primary Habitat Type	Water Depth at Pool Tail Crest (ft)	Left Stream Bank Soil Composition
Secondary Habitat Type	Dominant Substrate Ranking	Right Stream Bank Soil Composition
Pool Type	Subdominant Substrate Ranking	Left Stream Bank Slope Ranking
Number of Channels in the Habitat Unit	Area of Spawning Gravel (sq. ft.)	Right Stream Bank Slope Ranking
Channel Surveyed	Quality of Spawning Gravel Ranking	Left Stream Bank Height (ft)
Flow Split for Multiple Channels (L,M,R)	Quality of Spawning Gravel Constraints Ranking	Right Stream Bank Height (ft)
Cumulative Length to	Rearing Habitat Quality	Left Stream Bank

Habitat Unit Downstream End (ft)	Ranking	Stability Ranking
Cumulative Length to End of Habitat Unit Upstream (ft)	Rearing Habitat Quality Constraints Ranking	Right Stream Bank Stability Ranking
Length of Habitat Unit (ft.)	Area of Aquatic Vegetation (sq. ft.)	Left Stream Bank unknown
Channel Width (ft)	Area of Woody Debris (sq. ft.)	Left Stream Bank Floodplain Connectivity Ranking
Channel Area	Benthos Quality Potential Ranking	Right Stream Bank Floodplain Connectivity Ranking
Water Velocity Rating	Terrestrial Drift Quality Potential Ranking	Left Stream Bank Floodplain Terrace Present
Right Stream Bank Floodplain Terrace Present	Left Stream Bank Vegetative Armor Ranking	Right Bank Vegetative Armoring
Left Stream Bank Riparian Complexity Rating	Right Stream Bank Vegetative Armor Ranking	Notes
Right Stream Bank Riparian Complexity Rating	Left Bank Vegetative Armoring	

Source: California Sportfishing Protection Alliance, unpublished data.

2. FEIR Teichert Aggregate Facility: Jones and Stokes Associates conducted a 1999 habitat survey in the Coon Creek channel from Highway 65 upstream to Gladding Road. The survey protocol is reported to be the same as used by Stacy Li and referenced immediately above. Reference is made to some partial habitat surveys made in 1994 and 1995 and a simple comparison between the percentages of pools, runs, and riffles is presented for the 1999 and 1994-95 surveys for comparable stream channel areas. The following table comes from a Technical Memorandum presented in Appendix J14 of the FEIR and describes the physical habitat conditions found during the 1999 survey. **Source: FEIR Teichert Aggregate Facility 2000, Placer County Planning Dept.**

Habitat Type	Total Length (ft.)	Percent of Total Habitat Surveyed
Mid-Channel Pool	11,114	48.0
Lateral Scour Pool	2,014	8.7
Dammed Pool	51	0.2
Channel Confluence Pool	136	0.6
Run	3,372	14.6
Glide	983	4.3

Low-Gradient Riffle	5,452	23.6

Source: FEIR Teichert Aggregate Facility 2000, Placer County Planning Dept.

3. 2003 Placer County Spawning Gravel Survey: During the summer of 2003, Placer County funded a survey to examine steelhead trout spawning gravels in this drainage (as well as others). No data are currently available from this effort.

4. 2003 Placer County Stream Videography Project: On March 12, 2003 Coon Creek was videotaped from the air, beginning at Highway 49 in Auburn, downstream into the Eastside Canal near its confluence with Auburn Ravine. Review of the video footage shows the riparian area of the stream varies from very poor quality (downstream areas) to very high quality (upstream of Gladding Road). Also, this footage revealed extensive bank erosion that is contributing to the sediment load in the stream. The proportion of the excessive sediment load attributable to bank erosion versus decomposition of underlying rock formations is unknown. Sediment contributions from land disturbing activities and roadways are also unknown. Based on the video footage, the downstream reach (below Gladding Road) should be considered as a migratory corridor only. This area is mostly sand bottomed, low gradient channel with little potential for accommodating good quality spawning or rearing habitats for anadromous fish. The area between Gladding Road and the waterfalls/cascade section in the canyon upstream of Garden Bar Road appears to be suitable spawning and rearing area for both chinook salmon and steelhead trout. The area upstream of the waterfalls/cascades physically appears to be excellent steelhead and potentially good chinook habitat, if fish passage were provided into this section of the stream. **Source: 2003 Placer County Stream Videography Project, unpublished data.**

E. Fishery Resource Data

1. Documented Fish Species Present in the Stream

California roach
Pacific lamprey (indirect evidence)
White catfish
Bullhead (no species given)
Bluegill
Carp
Rainbow trout/steelhead
Sacramento sucker
Brook lamprey
Green sunfish
Log perch
Golden shiner
Mosquitofish
Hitch
Hardhead
Brown trout
Fall-run chinook salmon (native)
Fall-run chinook salmon (introduced – Feather River Fish Hatchery)
Fall-run chinook salmon (introduced – Nimbus Fish Hatchery)
Spring chinook salmon (introduced – Feather River Fish Hatchery)
Sacramento pikeminnow (formerly known as Sacramento squawfish)

Source: California Department of Fish and Game, Region 2 files, Teichert Aggregate Facility FEIR

2. Fish Stocking Records

The following stocking records were found in CDFG's Region 2 files:

Species	Origin	Date	Size (No./lb)	Mean Length*	Number Stocked	Location
Brown trout	Mt. Shasta	6/25/30			30,000	Dry Creek tributary to Coon Creek
Brown trout	Mt. Shasta	7/1/32			10,000	Dry Creek tributary to Coon Creek
Rainbow trout	Mt. Shasta	8/8/45	12	150	1,308	USGS Quad Map coordinates indicate Dry Creek in Auburn
Spring chinook	Feather R. FH	2/21/85	616	45	104,720	Gladding Road
Fall-run chinook	Feather R. FH	2/3/86	480	48	24,000	McCourtney Road
Fall-run chinook	Feather R. FH	1/28/87	704	42	24,640	McCourtney Road
Fall-run chinook	--	1/11/89	1,072	37	100,700	McCourtney Road
Fall-run chinook	Nimbus FH	1/25/90	1,245	35	124,500	McCourtney Road
Fall-run chinook	Feather R. FH	2/26/92	764	41	114,600	Garden Bar Road
Fall-run chinook	Nimbus FH	2/19/93	1,165	36	50,095	Garden Bar Road
Fall-run chinook	Nimbus FH	2/22/93	1,165	36	50,095	Garden Bar Road
Fall-run chinook	Nimbus FH	2/3/94	1,100	37	107,800	Garden Bar Road
Fall-run chinook	Nimbus FH	2/6/95	1,040	37	99,840	Garden Bar Road
Fall-run chinook	Nimbus FH	1/9/96	1,200	36	102,000	Garden Bar Road
Fall-run chinook	Nimbus FH	2/26/97	720	42	102,000	Garden Bar Road

*Length estimates (mm) from Fish Hatchery Management, Fish and Wildlife Service, 1992.

3. Adult Spawning Timing, Distribution, and Population Estimates

- **1964 Fall-run Chinook Salmon Spawning Survey by Eric Gerstung:** Gerstung noted on November 23, 1964 that local ranchers indicated that no run came upstream to spawn this fall. No survey was conducted on Coon Creek. **Source: May 25, 1965 memorandum in CDFG, Region 2 files.**

- **December 6, 1985 Spawning Survey:** Two locations on Coon Creek were surveyed for fall-run chinook salmon on 12/6/85. The first location was approximately one mile upstream and downstream of Garden Bar Road. The second location was a ¼ mile survey downstream of McCourtney Road. No fish or redds were observed. A 4ft. waterfall was noted one mile downstream of Garden Bar Road. This might be a barrier at certain flows. Flows were estimated at 20-40 cfs, with higher flows earlier. **Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.**

- **1991 Memorandum entitled "Recollection of Auburn Ravine Creek, Coon Creek and Dutch Ravine Creek by Ancle "Slim" Goodall":** This memo documents the memories of Mr. Goodall regarding his fishing and species caught starting in 1939 or 1940. Mr. Goodall fished Coon Creek and Otto recorded "Coon Creek held "spotted native trout" which lived primarily in the shade. Goodall said that the old timers said they'd seen them in the Gold Rush days. Goodall caught trout of this type up to 19 or 20". The fish had brown spotted backs with a rainbow's stripe and olden sides below, and looked to him like a cross between a brown and rainbow trout. In addition, he caught sunfish, catfish, perch, pike and steelhead in the upper stretches of Coon Creek. He saw salmon in the stream above the Garden Bar Bridge. They did not go as far upstream as the steelhead. Goodall said Orr Creek held plenty of trout, as well. **Source: May 26, 1991 Conversation Documented by Ron Otto.**

- **Miscellaneous Anecdotal References:** Three local residents have told me that they have seen adult chinook salmon and steelhead in the watershed. Wayne Vineyard remembers removing adult chinook salmon during the fall when he was "a kid" which would be approximately 50+ years ago. Al Fleming told me that he handled a 56-pound adult chinook in the fall of 1985 from the "upper ranch" property, which is just downstream of Garden Bar Road. Mike Wilson, manager of the Foggy Ranch at Garden Bar Road grew up in the watershed and reports seeing adult chinook salmon and steelhead in the vicinity of Garden Bar Road and upstream on a fairly routine basis over the last 30-40 years.

4. Juvenile Distribution and Sampling Data

- **Spring 1965 Fall-run Chinook Salmon Juvenile Emigration Survey by Eric Gerstung:** Gerstung began trapping downstream migrant fall-run chinook juveniles in both channels of Coon Creek just downstream of McCourtney Road on 3/4/1965 and continued through 3/15/1965 and 3/22/65 on the south and north channels, respectively. The stream was sampled using a "riffle" trap or perforated plate trap. The north-channel trap fished a total of 308.75 hours and captured no juvenile chinook salmon. The south channel trap fished a total of 266.25 hours and captured no juvenile chinook salmon. Water clarity was recorded as clear for each day [11-16 days] the traps were checked over this time period. Water temperatures were recorded at the time the traps were checked and are reported above, in the water temperature section of this report. No other fish species catch composition data is reported. **Source: May 25, 1965 memorandum**

in CDFG, Region 2 files, handwritten draft of May 25, 1965 memo, and other handwritten notes.

- **April 1983 One-time Seining Event:** The Department of Fish and Game conducted a one-time seining event on April 5, 1983 just upstream of Highway 65. Catch composition is reported as: one 92 mm chinook juvenile, 3–squawfish, 1-sucker fry, and 1-green sunfish. Water temperature was recorded as 54^{O} F at 0845. **Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.**

- **1984 Seining and Electrofishing for Native Brood Year 1983 Fall-run Chinook Salmon:** Water temperatures for this sampling effort are reported above. The following sampling results are reported for this sampling effort: **Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.**

Date	Effort	No. Chinook	Length Mode (mm)	Length Range (mm)	Other Fish Species	Location
2/28/84	3 seine hauls	0	0	--		McCourtney Road
2/28/84	2 seine hauls	13	62	32-63	1-hardhead 2- squawfish*	Highway 65
3/27/84	Electrofish. No length	55	46	40-51		McCourtney Road
3/27/84	Electrofish. No length	1	63	63		Highway 65
4/10/84	2 seine hauls	0				Highway 65
5/2/84	2 seine hauls	4		71-83	2 – squawfish 2- carp	McCourtney Road
5/2/84	2 seine hauls	2		85-95	30-squawfish	Highway 65
5/24/84	2 seine hauls	0			1-squawfish; 1 – hitch; “lots” of sucker fry	Highway 65

* Sacramento squawfish are now known as Sacramento pikeminnow.
Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.

- **Dowd Road Juvenile Trapping Survey May 9-17, 1992:** This data is from a short-term juvenile chinook salmon trapping program on Coon Creek. The trapping location was located approximately 100 yards downstream of Dowd Road. Four perforated plate traps were installed on 5/9/92 with an additional three traps installed on 5/10/92. Flow during trapping was estimated at 10-20 cfs. **Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.**

Date	Time	Catch Composition
5/10/92	0850	No chinook, mosquitofish, log perch, white catfish, green sunfish, suckers and fry
5/11/92	0630	No chinook, hitch, brook lamprey, squawfish, bluegill, golden shiners

5/12/92	0630	2-chinook ≈ 90 mm, adult squawfish, 1-hitch, usual species
5/13/92	0600	No chinook, big suckers ≈ 3lbs.
5/14/92	0600	No chinook, usual fish
5/15/92	0700	No chinook, usual fish
5/16/92	0630	No chinook, usual fish
5/17/92	0620	3-chinook ≈ equal size, plus 1-93 mm; usual fish

Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.

- **1994-1995 Fish Resource Surveys for the Proposed Teichert Aggregate Facility:** Jones and Stokes Associates conducted fish resource surveys on the Wilson and Hoffman ranches in the Coon Creek channel between Highway 65 and Gladding Road. No specifics of the sampling protocol are given. Juvenile chinook salmon are reported as being seen, but were not captured during the sampling. The following catch composition table is adapted from Table 15-1 in the FEIR. **Source: FEIR Teichert Aggregate Facility 2000, Placer County Planning Dept.**

Species Common Name	Length Range (mm)	Number Captured
Sacramento pikeminnow	53-191	49
Sacramento sucker	84-167	45
Hardhead	75-200	11
Hitch	100	1
California roach	83	1
Bullhead sp.	40-85	3
Channel catfish	---	2
Green sunfish	52-55	2

Source: FEIR Teichert Aggregate Facility

F. Fish Passage or Screening Data

1. Man-Made Structures or Pumping Stations

Three diversion structures in the watershed are of interest to this assessment:

- **Coppin Dam:** The dam, operated by South Sutter Water District, is located in the Eastside Canal just downstream of its confluence with Auburn Ravine. This is a flashboard diversion dam that operates during the irrigation season, nominally mid-April to October. Since the flashboards are out during the time period when chinook salmon and steelhead adults would be attempting to enter the watershed, this location is not a concern for adult passage. However, there are two anecdotal reports (Ron Otto and Riley Swift, pers. comm.) of half-pounder steelhead migrating upstream in Auburn Ravine during May. This diversion dam is operating during that time period and could provide a passage barrier to these fish. It is unknown if half-pounder steelhead attempt to migrate upstream into the Coon Creek Watershed. If they do, there is a relatively inexpensive and simple fix to provide passage over this flashboard dam.

- **Concrete Diversion Structure on the Teichert Aggregate Property:** In the FEIR for the Teichert Aggregate Facility, there is discussion and mitigation regarding a concrete flashboard dam on the Wilson property, which is about midway between Gladding Road and Highway 65 (see Figure 15-3 in the FEIR). Review of the videotape from the County's Videography Project shows this concrete diversion dam has been breeched on the south bank by high flows and does not appear to be an adult fish passage problem at this time. However, what appears to be a new concrete weir/chute structure appears to have been placed in and across the entire stream channel upstream, immediately downstream from Gladding Road. From the videotape footage it is impossible to determine the height or water velocity through this structure. This structure is not mentioned in the Fish Resources Chapter of the FEIR, and no fish passage provisions associated with this structure were obvious during review of the videotape. Specific information and specifications regarding are necessary in order to determine if a fish passage impediment is present during certain flows.

- **Camp Far West Ditch Canal Diversion:** Review of the VHS tape for the upper portion of the watershed near Bell Road in North Auburn shows a diversion structure, which I believe is the Camp Far West Ditch Diversion. This structure and unscreened diversion is located upstream of any nominal anadromous fish distribution at this time. However, if anadromous fish passage were provided over the impediments in the canyon portion of the watershed, upstream of Garden Bar Road, then juvenile anadromous fish exclusion concerns would need to be addressed.

Several pumping stations are located along the stream channel. It is unknown if any of these pumping stations pose a major threat to emigrating anadromous fish juveniles. However, I suspect that the risk is minimal from these locations because they are generally not in operation until irrigation season and by the nominal start date of mid-April, water temperatures downstream in the Eastside Canal and Cross Canal are most likely lethal anyway. This situation deserves further evaluation, but it is probably a low priority.

2. Water Flows

Fall and winter water flows are particularly important in Coon Creek. Because water deliveries are curtailed, generally before fall-run chinook salmon attempt to migrate upstream to spawn, the depth of water in the channel can be insufficient to provide adult passage. Adult chinook salmon and steelhead need approximately 1$\pm$ foot of water depth with some resting pools in order to migrate upstream. Transit time for adult fish from the Cross Canal confluence to upstream of Gladding Road could routinely be accomplished in two to three days. However, adequate water depth is critical and should be taken into consideration concurrently with any fish passage projects for this drainage. The County of Placer has been purchasing water to dilute its flows from SMD #1, but the quantity of water is inadequate to provide fish passage from Auburn downstream to the Eastside Canal.

3. Beaver Dams

Beaver dams and beaver activity are known to adversely affect adult anadromous fish passage in this watershed. During the stream videography project, six beaver dams capable of affecting passage were documented from the air between the confluence with Eastside Canal and the area upstream of the McCourtney Road crossing on March 12, 2003. During the fall/winter of 2002/2003, a major beaver dam was located approximately ¼ mile downstream of the McCourtney Road crossing on the South Channel. This dam remained in place and appeared to block adult fish passage for the entire spawning season for both fall-run chinook and steelhead, although anecdotal evidence from local ranchers indicate that at least one chinook salmon did migrate upstream to the Spear Ranch property upstream of Garden Bar Road. The North Channel appeared to be a barrier all winter long because of low flows.

APPENDIX COON CREEK 1

HEAVY METALS COMPARISON
BETWEEN COON CREEK AND EASTSIDE CANAL

	Assumes a Hardness Of 50 mg/l as CaCO3	Maximum Concentration (Acute)	Continuous Concentration (Chronic)			
	METAL	**(mg/l)**	**(mg/l)**			
	Barium	No standard	No standard			
	Cadmium	0.002	0.0013			
	Copper	0.007	0.005			
	Zinc	0.067	0.066			

Stream	Location	Date	Cadmium mg/l	Copper mg/l*	Zinc mg/l	Notes
Coon Creek	Sutter County	01/25/01	0.000042	0.00446	0.00658	Hardness = 65 mg/l
Coon Creek	Sutter County	03/01/01	0.000056	**0.0106**	0.0101	Hardness = 76 mg/l
Coon Creek	Sutter County	04/05/01	0.000028	0.00395	0.00276	Hardness = 72 mg/l
Coon Creek	Sutter County	05/03/01	0.000045	**0.00548**	0.00376	Hardness = 72 mg/l
Coon Creek	Sutter County	06/06/01	0.000024	**0.0458**	0.00213	Hardness = 50 mg/l
Coon Creek	Sutter County	07/17/01	0.000019	0.00197	0.00153	Hardness = 173 mg/l
Coon Creek	Sutter County	08/02/01	0.000007	0.0008	0.00096	Hardness = 176 mg/l
Coon Creek	Sutter County	09/06/01	0.000011	0.00284	0.00146	Hardness = 47 mg/l
Coon Creek	Sutter County	10/11/01	0.000013	0.00387	0.00115	Hardness = 65 mg/l
Coon Creek	Sutter County	10/31/01	0.000007	0.00288	0.0014	Hardness = 64 mg/l
Coon Creek	Sutter County	12/21/01	0.000125	**0.0157**	0.0162	Hardness = 63 mg/l
Cross Canal	Sutter County	01/25/01	0.000039	0.00445	0.00555	Hardness = 65 mg/l
Cross Canal	Sutter County	03/01/01	0.000052	**0.011**	0.0102	Hardness = 72 mg/l
Cross Canal	Sutter County	04/05/01	0.000014	0.00299	0.00301	Hardness = 46 mg/l
Cross Canal	Sutter County	05/03/01	0.000015	0.00298	0.0019	Hardness = 46 mg/l
Cross Canal	Sutter County	06/06/01	0.000023	0.00214	0.00113	Hardness = 52 mg/l
Cross Canal	Sutter County	07/17/01	No Flow	No Flow	No Flow	No Flow
Cross Canal	Sutter County	08/02/01	0.000015	0.00278	0.00291	Hardness = 59 mg/l
Cross Canal	Sutter County	09/06/01	0.000014	0.00302	0.0026	Hardness = 70 mg/l
Cross Canal	Sutter County	10/11/01	0.000013	0.00343	0.00236	Hardness = 65 mg/l
Cross Canal	Sutter County	10/31/01	0.000015	0.00354	0.00228	Hardness = 63 mg/l
Cross Canal	Sutter County	12/21/01	0.000098	**0.0117**	0.0158	Hardness = 58 mg/l

***** Values in bold exceed California Toxics Rule objectives for aquatic life at a hardness of 50 mg/l.

Sources: California Toxics Rule (water quality objectives); Department of Water Resources unpublished data.

APPENDIX COON CREEK 2

BENTHIC MACROINVERTEBRATE DATA
COLLECTED BY THE AUBURN RAVINE CITIZENS GROUP

PHYLUM / Class / Order / Family / *Genus species*	TV[1]	FFG[2]	CCF-A	CCF-B	CCF-C
			12/01/00 Coon Creek @ upper Fleming		
ARTHROPODA					
Hexapoda					
Coleoptera (Larvae)					
Elmidae	5	cg	6	11	6
Psephenidae	4	sc		1	
Diptera					
Chironomidae	6	cg	20	13	4
Empididae	6	p	2		
Simuliidae	6	cf	7	17	70
Tipulidae	3	sh		1	
Ephemeroptera					
Baetidae	4	cg	23	18	5
Ephemerellidae	1	cg			
Leptohyphidae	4	cg	8	7	2
Plecoptera					
Capniidae	1	sh			
Chloroperlidae	1	p			
Perlodidae	2	p			
Trichoptera					
Brachycentridae	1	ot	8	6	1
Glossosomatidae	0	sc			
Hydropsychidae	4	cf	4	8	2
Hydroptilidae	4	ot			
Leptoceridae	4	ot			
Philopotamidae	3	cf		3	1
Lepidostoma					
Pyralidae	5	sc	2		
Odonata					
Coenagrionidae	9	p	4	2	
Gomphidae	4	p			
Libellulidae	9	p			
Subphylum Chelicerata					
Arachnoidea					
Hydracarina (=Acari)	5	p			
Subphylum Crustacea					
Malacostraca					
Amphipoda	4	cg	1		
MOLLUSCA					
Gastropoda					

Limnophila					
Planorbidae	6	sc			
Bivalvia					
Pelecypoda					
Corbiculacea	10	cf		1	
NEMATODA	5	p			
NEMERTEA			1		
PLATYHELMINTHES					
Turbellaria					
Tricladida					
Planariidae	4	p	3	3	2
ANNELIDA					
Oligochaeta	5	cg	6	1	1
		Total Macroinvertebrates:	95	92	94
[1] TV: Tolerance Values					
[2] FFG: Fuctional Feeding Groups					
Taxonomic Richness			14	14	10
EPT Taxa			4	5	5
Ephemeroptera Taxa			2	2	2
Plecoptera Taxa			0	0	0
Trichoptera Taxa			2	3	3
EPT Index			45	46	12
Sensitive EPT Index			8	10	2
Tolerance Value			4.7	4.7	5.6
Percent Intolerant Organisms			8	11	2
Percent Tolerant Organisms			4.2	3.3	0.0
Percent Dominant Taxon			24	20	74
Percent Collectors			67	54	19
Percent Filterers			12	32	78
Percent Grazers			2	1	0
Percent Predators			9	5	2
Percent Shredders			0	1	0
Other			8	7	1
		Dec-00			
		Coon Creek @			
		upper Fleming			

	Mean	SE	CST
Taxonomic Richness	13	1.3	18
EPT Taxa	5	0.3	5
Ephemeroptera Taxa	2	0.0	2
Plecoptera Taxa	0	0.0	0
Trichoptera Taxa	3	0.3	3
EPT Index (%)	34	11	34
Sensitive EPT Index (%)	7	2.4	7
Dominant Taxon (%)	39	18	33
Tolerance Value	5.0	0.3	5.0
Intolerant Organisms (%)	7	2.6	7
Tolerant Organisms (%)	2.5	1.3	2.5
Collectors (%)	47	14	47
Filterers (%)	40	20	40
Grazers (%)	1	0.6	1
Predators (%)	6	2.1	6
Shredders (%)	0	0.4	0
Other (%)	5	2.2	5
* Site statistics based on small and variable sample sizes			

CURRY CREEK

The literature review for Curry Creek did not result in any information related to:

- Existing Water Quality Data
- Water Temperature Data
- Benthic Macroinvertebrate Data
- Physical Habitat Data
- Fishery Resource Data
- Fish Passage or Screening Data

I reviewed all of the pertinent environmental documents produced by the City of Roseville and searched the fisheries files at the California Department of Fish and Game's Region 2 office. Since Curry Creek is currently intermittent, environmental documents focus on wetlands, vernal pools, and riparian issues, but not on water quality, benthic macroinvertebrates, or fishery resources. In fact, CDFG does not even have a file for Curry Creek, let alone any data in that non-existent file. However, I did visit all of the accessible road crossings of the channel and during several flights looking for salmon in other drainages, did fly over the stream channel on several occasions. During the stream videography project in March 2003, we did not fly Curry Creek because of time and priority constraints. Therefore, my assessment of this stream's potential to support anadromous fish is based on my limited road crossing and several over flight observations. *[This assessment is basically repeated in the Assessment Report prepared for Placer County]*.

A. Water Quality

Assessment: Observations of water quality left me with one solid observation and one impression. During the fall and early winter the turbidity levels were high, with the water being chocolate brown in color. The impression that I have is that nutrient levels might be unsuitable for anadromous fish, should they ever enter the system. This impression is based on the amount of aquatic vegetation growing in the channel, during the winter period and an overall sense of high botanical productivity in the immediate channel area.

B. Water Temperature

Assessment: Although no data is available, my belief is that water temperatures, if perennial flow were to become the norm, would be unsuitable in summer for juvenile salmonid rearing. I base this conclusion on two factors. First, the volume of flow in the channel would be low, unless an artificial discharge supplemented the natural flow, resulting in rapid heating during the spring and summer months. Second, the gradient of the channel is very low which would result in long residence times for water and thus greater opportunity for temperature increases.

C. Benthic Macroinvertebrates

Assessment: In the event the channel did become perennial at some future date, I speculate that the substrate would be composed of fine particles to coarse sand. This substrate would support a low diversity and numbers of organisms that would be suitable as a food source for salmonids.

D. Physical Habitat

Assessment: This stream channel is very low gradient and the surrounding soils are mostly fine textured. Given these constraints, I do not believe that this stream could ever possess the physical characteristics to support salmonid species. The lack of stream power to scour pools and gravels, if any gravel even exists under the existing channel, would render this stream unsuitable as habitat for anadromous salmonids. Also, the lack of sediment transport ability would further hinder the likelihood that suitable conditions could be created. A lack of riparian vegetation would also limit the potential development of habitat complexity.

E. Fishery Resources

Assessment: Based on the location, gradient, soils, and other factors associated with this channel, I believe that this stream has close to zero potential as an anadromous fish stream. The current conditions, and I believe most likely future conditions in the channel do not meet most, if any, of the requirements necessary to support anadromous fish. I do believe that this channel should be kept intermittent, if possible, to avoid false attraction of anadromous species and to minimize the introduction or expansion of undesirable warmwater fish species into other watersheds.

F. Fish Passage or Screening

Assessment: During the over flights, I believe I did see several beaver dams in the lower portion of the drainage, but cannot confirm that observation as fact. If by some chance stream conditions became suitable for anadromous fish, then the beaver situation would have be dealt with in the manner recommended for other watersheds.

DOTY RAVINE

A. Water Quality Data

1. Lincoln High School Water Quality Monitoring: Mark Fowler and Lee Beckman provided this data from the Lincoln High School sampling program, which was jointly funded by NID, Placer County, and the City of Lincoln. While data for Doty Ravine are limited, three parameters are of concern from a stream ecology standpoint. First, the pH readings from the Garcia Property are relatively high and correlate with a trend of unusually high pH values in the Western Placer County streams, particularly in the fall. Second, the dissolved oxygen concentrations reported show supersaturated levels of approximately 150%, which is unusual for lower gradient streams. This trend is also noted in other local streams. Third, the concentrations of nitrate reported are high for a fall reading and could indicate eutrophication of the stream, particularly during the summer months. Without data on orthophospate for comparison, it is impossible to determine if nitrates are limiting biostimulation of algal growth and potentially causing diurnal dissolved oxygen fluctuations during the nighttime hours. Excessive algal growth has been observed in other local streams. The limited quantity of water quality data available for Doty Ravine does not allow any definite conclusions to be drawn. **Source: Lincoln High School Water Quality Monitoring, unpublished data.**

Table 1. Doty Ravine Water Quality Data 2001-2002

Parameter	Garcia Property	Garcia Property	Weygant Property	Unnamed NID canal
Date	10/7/2001	10/14/2001	10/27/2002	5/6/2002
Time	1146	0945	--	0620
Air Temperature (^{O}F)	--	--	68	51
Water Temperature (^{O}F)	64	60	56	56
Weather	Clear	Clear	Clear	Clear
Stream Flow (cfs)	2	0.7	1.4	--
pH	8.1	8.7	7.3	8.1
Dissolved Oxygen (mg/L)	16.5	14.1	16.5	16.5
Electrical Conductivity (μs/cm)	106.2	122.1	170.2	61.1
Color (color units)	2	0	5	61
Nitrates (mg/L)	1.8	1.4	0.8	1.0
Chlorides (mg/L)	0.03	0.04	0.00	0.10
Total Coliform (MPN/100ml)	2400	240	43	240
Fecal Coliform (MPN/100ml)	150	240	43	240

Source: Lincoln High School Water Quality Monitoring, unpublished data.

2. Auburn Ravine/Coon Creek Ecosystem Restoration Plan: In the background information for this Plan, there is reference to a one-time sampling conducted by CH2MHill on 2/1/1996. The parameters apparently measured were dissolved oxygen, pH, turbidity, and water temperature, but no data are provided. **Source: unpublished data, Bob Coats, Hydroikos Consulting, San Rafael, CA.**

B. Water Temperature Data

Water temperature data from various one-time fish sampling projects conducted by the CDFG are presented below, most of the data from monitoring conducted by Bailey Environmental, which includes hourly readings. Due to limitations in the statistical package, only 3,000 temperature data points can be displayed in a single time series plot. Since daily maximum, minimum, and/or mean temperatures individually are of little value, I have chosen to plot all data points. Therefore, I have split the year into time periods that roughly correspond to:

Fall-early winter: September though December; primary fall-run chinook salmon spawning period is November-December.
Winter-spring: January though April; fall-run chinook salmon incubation and rearing and steelhead spawning, incubation, and rearing.
Late spring-summer: May to September; summer rearing for steelhead juveniles.

Data plots for these time periods are presented below to allow the reader to assess the potential of Doty Ravine to support chinook salmon and/or steelhead trout spawning and rearing. A variety of local data and literature was reviewed, to characterize the general effects of water temperature on various life history stages for both chinook salmon and steelhead trout. There is fairly substantial variation in temperature effects noted for most life history stages, and both chinook salmon and steelhead are have a highly adaptable physiology and ability to seek thermal refuge during part of the day which may allow them to tolerate and/or avoid lethal temperatures. Some of the literature sources cite criteria from others and some of the data are based on fish captures with water temperature taken concurrently. Two tables with data and reference are included in Appendix A of this report. Based on this review, the following criteria have been used to indicate what life history stages a particular stream may support at any given time:

Chinook Salmon	**^{O}C**	**Steelhead Trout**	**^{O}C**
Egg and fry development	14.4 (58 ^{O}F)	Egg and fry development	14.4 (58 ^{O}F)
Juvenile rearing	21.1 (70 ^{O}F)	Juvenile rearing	22.2 (72 ^{O}F)
Adult migration	21.7 (71 ^{O}F)	Adult migration and holding	22.2 (72 ^{O}F)

Reference lines for 14.4 ^{O}C and 22.2 ^{O}C have been provided on Figures 1-8 below to roughly represent the water temperatures suitable for salmonid spawning migration, egg and fry development, and juvenile rearing.

1. **Spring 1965 Fall-Run Chinook Salmon Juvenile Emigration Survey by Eric Gerstung:** The following water temperature data were reported in this survey. **Source: Hand written draft of May 25, 1965 memorandum in CDFG, Region 2 files.**

Date	Time	Temp. (^{O}F)	Location
2/24/65	1145	51	100 yards downstream of Gladding Road crossing
2/25/65	1125	51	100 yards downstream of Gladding Road crossing
2/27/65	1420	56	100 yards downstream of Gladding Road crossing
3/2/65	1200	54	100 yards downstream of Gladding Road crossing
3/3/65	1300	52	100 yards downstream of Gladding Road crossing
3/4/65	1230	54	100 yards downstream of Gladding Road crossing
3/8/65	1040	54	100 yards downstream of Gladding Road crossing
3/11/65	1300	--	100 yards downstream of Gladding Road crossing
3/12/65	1130	--	100 yards downstream of Gladding Road crossing
3/15/65	1240	58	100 yards downstream of Gladding Road crossing
3/17/65	1100	55	100 yards downstream of Gladding Road crossing

Source: Hand written draft of May25, 1965 memorandum in CDFG, Region 2 files.

2. **1984 Seining and Electrofishing for Native Brood Year 1983 Fall-Run Chinook Salmon. Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.**

Date	Time	Water Temp. (^{O}F)	Location
2/28/84	1330	53	McCourtney Road
2/28/84	1330	53	Garden Bar Road
3/27/84	1130	56	McCourtney Road
5/2/84	---	53	McCourtney Road

Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.

3. **Teichert Aggregate Project Area:** A water temperature of 61 ^{O}F was measured in Doty Ravine, upstream of Coon Creek, at 1100 hours on April 24, 1995. **Source: FEIR Teichert Aggregate Facility, County of Placer, December 2001.**

4. **Water Temperature Information from Bailey Environmental September 2001 to August 2003:** Figures 1-6 are for a single temperature monitoring station located approximately 200 yards upstream of the Crosby Herold Bridge crossing on the former property of the Garcia family. This station was discontinued in June 2003 because a new owner installed a new fence making access more difficult. This monitoring location was moved approximately 1,000 ft. upstream to the Munson property in June 2003. Beginning in June 2003, two additional monitoring locations were established at the Wise and Goldhill Road crossings. Data for June-August 2003 are presented in Figures 7 (Wise Road) and 8 (Goldhill Road). **Source: Bailey Environmental, unpublished data.**

Figure 1. Water temperature time series for Doty Ravine at the Garcia property, September through December 2001. Data indicate that successful fall-run chinook salmon spawning could have begun in late October/early November in 2001 and that conditions were suitable for juvenile rearing.

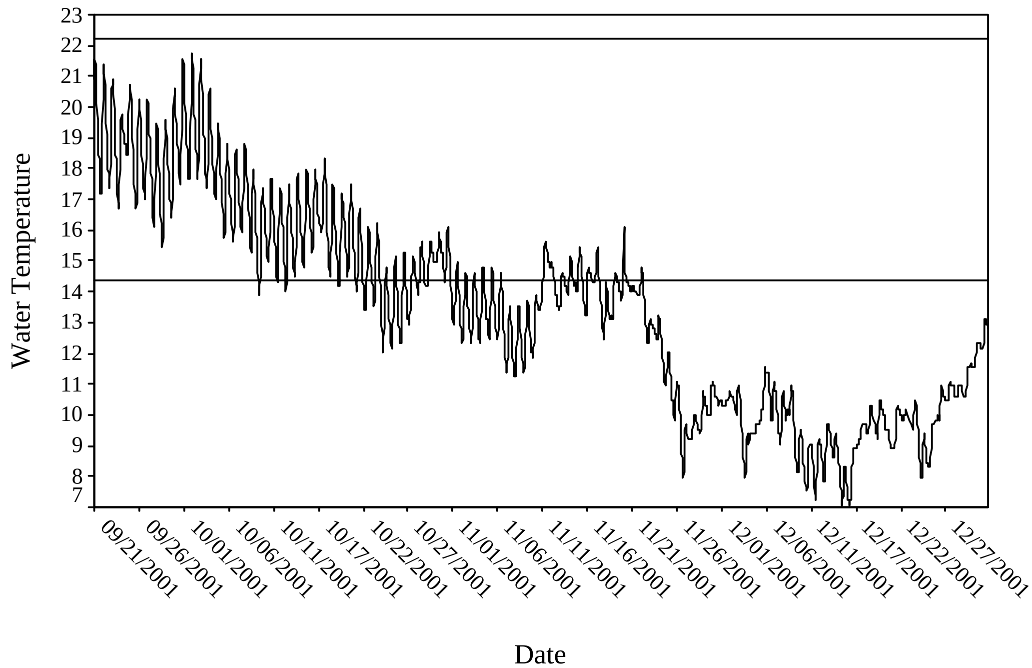


Figure 2. Water temperature time series for Doty Ravine at the Garcia property, January through April 2002. Temperatures are suitable for egg incubation and juvenile rearing.

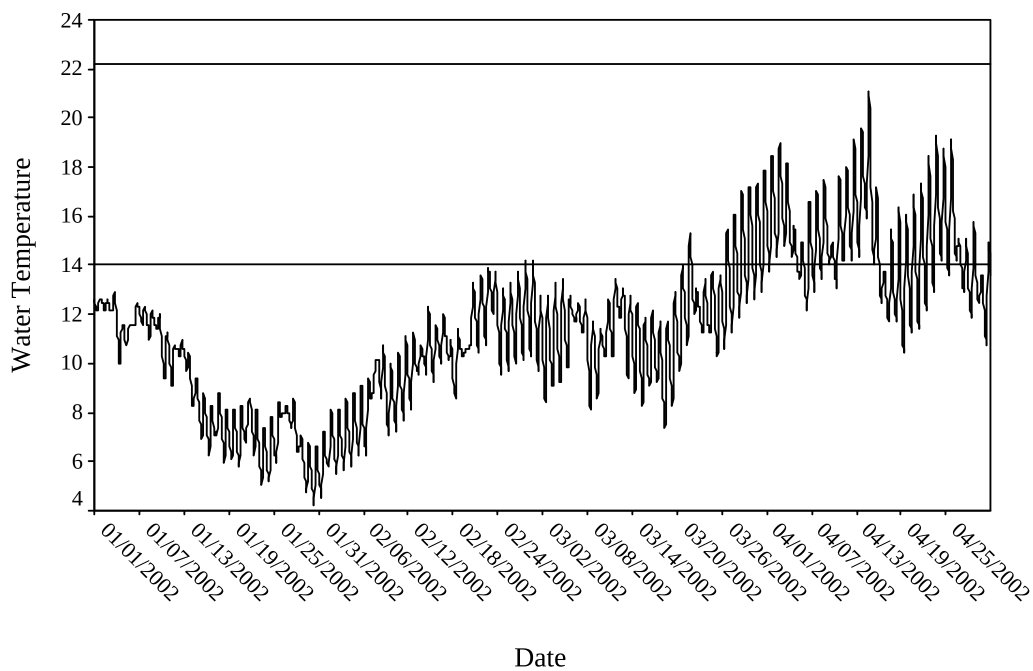


Figure 3. Water temperature time series for Doty Ravine at the Garcia property, May through August 2002. Temperatures are suitable for juvenile rearing, where data exists. However, the critical summer period has no data.

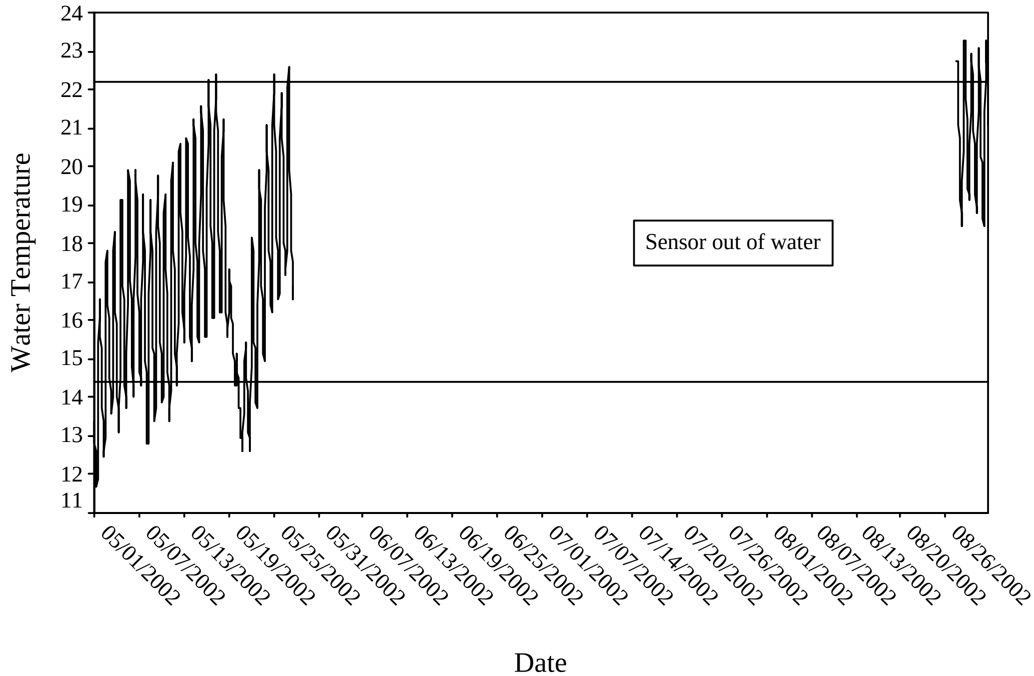


Figure 4. Water temperature time series for Doty Ravine at the Garcia property, September through December 2002. Data indicate that successful fall-run chinook salmon spawning could have begun in late October/early November in 2001 and that conditions were suitable for juvenile rearing.

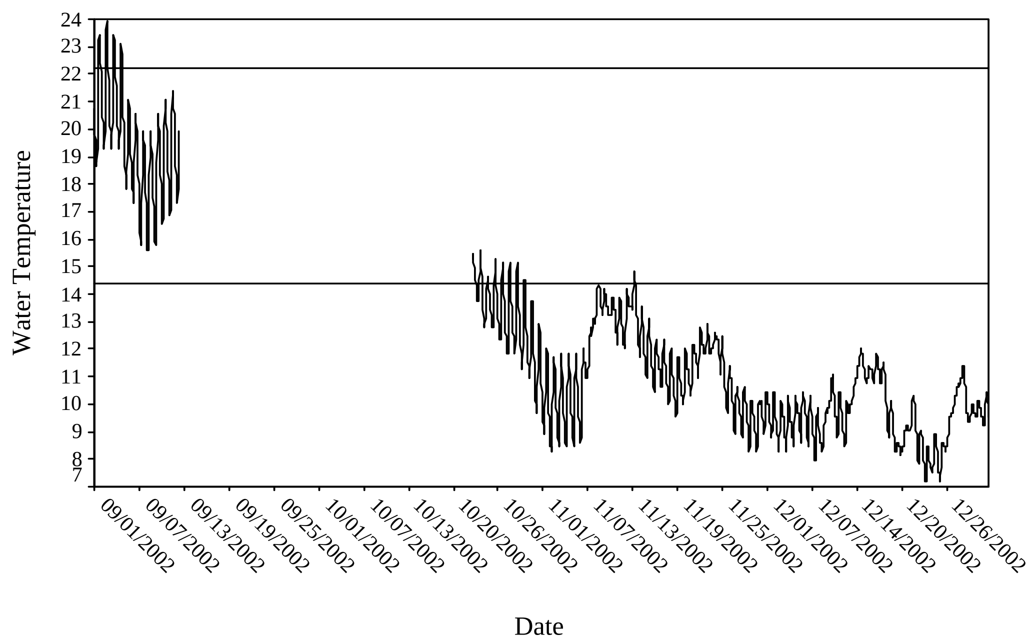


Figure 5. Water temperature time series for Doty Ravine at the Garcia property, January through April 2003. Temperatures are suitable for egg incubation and juvenile rearing.

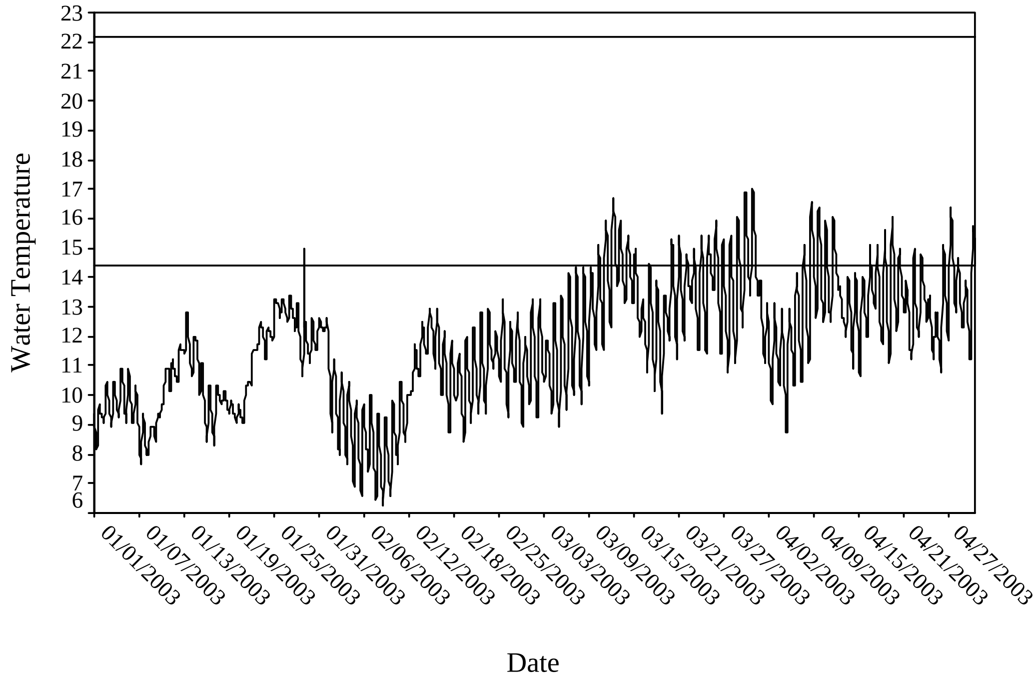


Figure 6. Water temperature time series for Doty Ravine at the Garcia property, May through August 5, 2003. Temperatures are suitable for juvenile rearing.

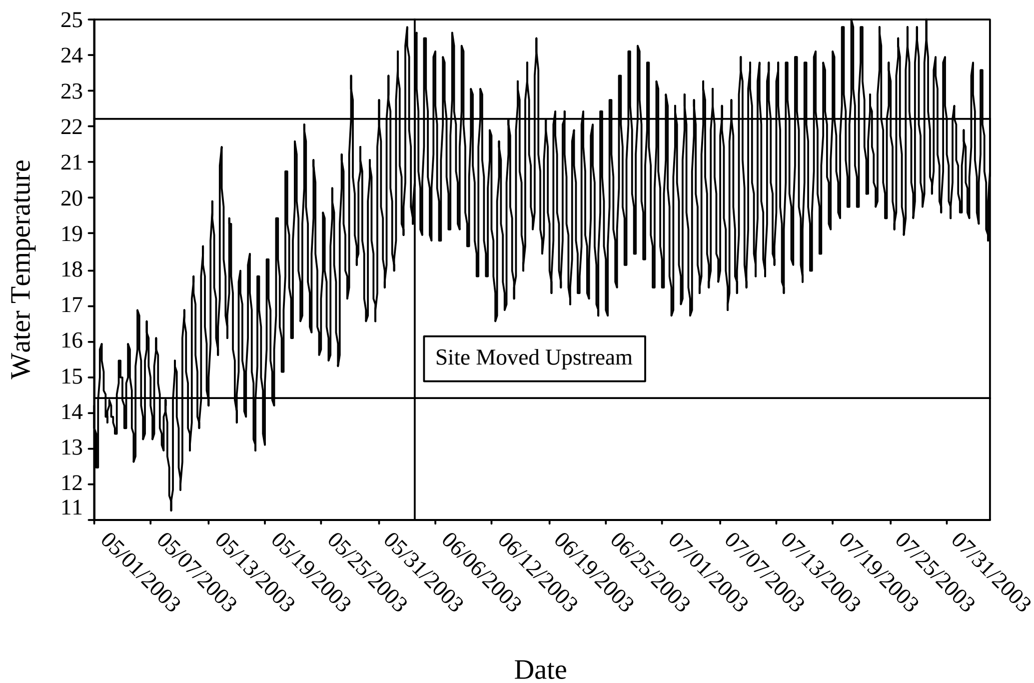


Figure 7. Water temperature time series for Doty Ravine at Wise Road, June 4 through August 5, 2003. Temperatures are suitable for juvenile rearing.

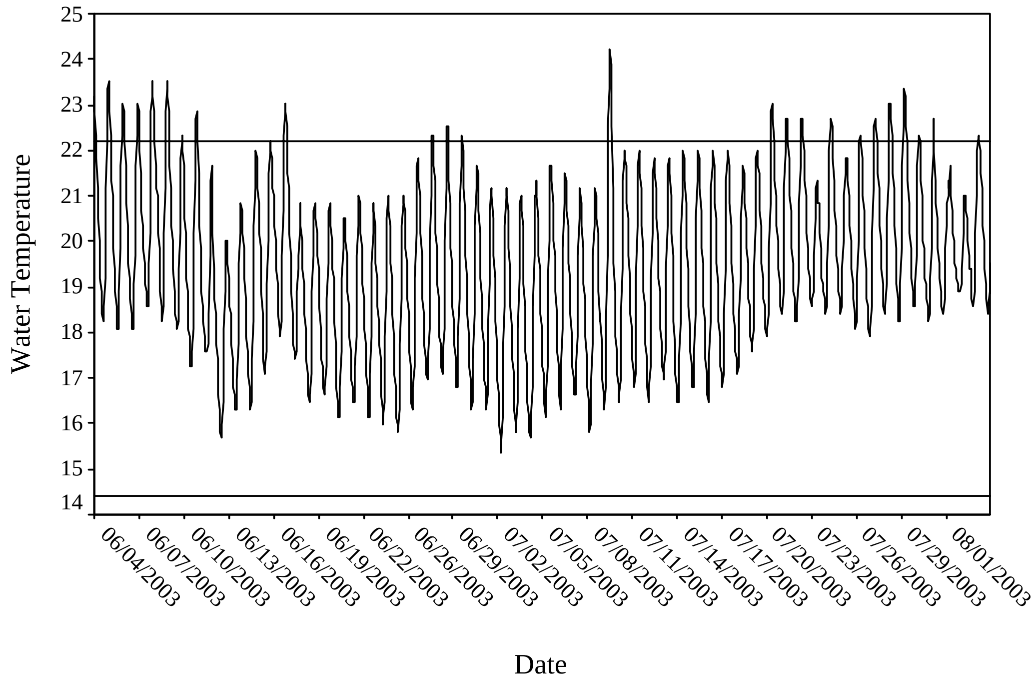
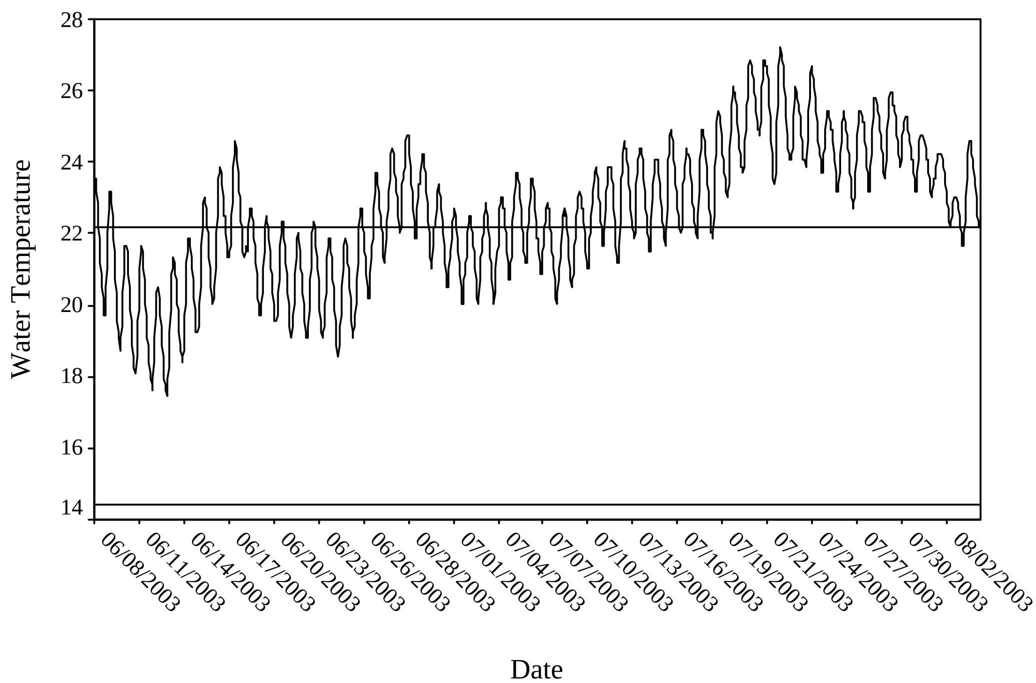


Figure 8. Water temperature time series for Doty Ravine at Goldhill Road, June 4 through August 5, 2003. Temperatures are marginally suitable for juvenile rearing.



C. Benthic Invertebrate Data

Limited benthic macroinvertebrate data (see Appendix Doty Ravine 1 for the complete data set) have been collected from Doty Ravine at the Garcia Property, just upstream of Crosby Herold Road. Samples were collected in December 2000, October 2001, and some unknown time in 2002 (Mark Fowler indicated that the 2002 samples have been collected, but analysis was not complete). The data are limited in usefulness for two reasons. First, samples were collected with equipment that does not readily collect all taxa present in the stream. Second, during the initial sorting, generally less than 100 individuals are selected for taxonomic identification. This limited sample size raises concerns regarding the representativeness of the data. However, the data do indicate that organisms that are moderately too highly tolerant of water quality impairment dominate the invertebrate community. A combination of flow fluctuations, water quality, and the amount of sediment in the stream channel probably contributes to this general lack of diversity and tendency towards species that are pollution tolerant. **Source: Benthic Macroinvertebrates sampled from Placer County Streams. Prepared for the Auburn Ravine Group by BioAssessment Services, Folsom, CA. December 2002.**

D. Physical Habitat Data

1. 1964 Chinook Salmon Spawning Gravel Survey [This information is not fully documented in CDFG files, and was based on an unsigned author note in CDFG, Region 2 files. I assume that this data is from Eric Gerstung's 1964 adult fall-run chinook salmon spawning surveys]. The following information was reported.

Section	Stream Miles	Distance Surveyed	Spawner Capacity/mi.	Salmon Use [Observed?]	Section Capacity
Coon Creek to McCourtney Rd.	4.0	--	50	0	1 mile w/ gravel = 50 fish
McCourtney Rd. to Fruitvale [Crosby Herold]	1.5	0.2	100	0	150
Fruitvale [Crosby Herold] to Garden Bar Rd.	1.0	0.3	100	0	100
Garden Bar Rd. to Wise Powerhouse Rd. [Wise Rd.]	1.0	--	50	0	50
Wise Powerhouse Rd. [Wise Rd.] to Goldhill Rd.	1.7	--	50	0	50

Source: Unsigned author note in CDFG, Region 2 files.

2. 2003 Placer County Spawning Gravel Survey: During the summer of 2003, Placer County funded a survey to examine steelhead trout spawning gravels in this drainage (as well as others). No data are currently available from this effort.

3. 2003 Placer County Stream Videography Project: On March 12, 2003 Doty Ravine was videotaped from the air from the confluence with Coon Creek upstream to a point above Wise Road. Review of the video footage shows that the riparian area of the stream varies from very poor quality to very high quality, depending on the location. Generally the degraded areas of riparian are in the downstream locations. Also, this footage revealed extensive bank erosion that is contributing to the sediment load in the stream. The proportion of the excessive sediment load attributable to bank erosion versus decomposition of underlying rock formations is unknown. Sediment contributions from land disturbing activities and roadways are also unknown. **Source: 2003 Placer County Stream Videography Project, unpublished data.**

E. Fishery Resource Data

1. Documented Fish Species Present in the Stream

Fall chinook salmon (native)
Fall chinook salmon (introduced – Feather River Fish Hatchery)
Spring-run chinook salmon (introduced – Feather River Fish Hatchery)
Sacramento pikeminnow (formerly known as Sacramento squawfish)
Sacramento sucker
Brown trout
Catfish (species undocumented)
Rainbow trout/steelhead
Tule perch
Source: California Department of Fish and Game, Region 2 files

2. Fish Stocking Records

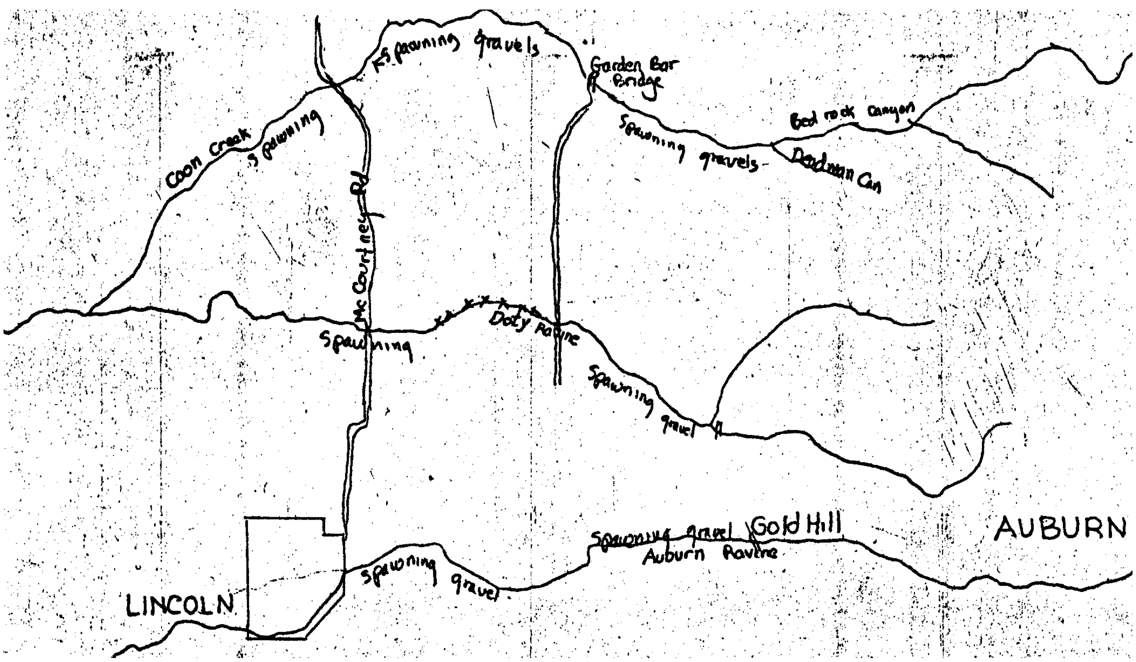
The following stocking records for chinook salmon were found in CDFG's Region 2 files:

Species	Origin	Date	Size (No./lb)	Mean Length*	Number Stocked	Location
Fall chinook salmon	Feather R. FH	1/27/87 or 1/28/87	704	42 mm	49,280	Garden Bar Road
Fall chinook salmon	Feather R. FH	1/31/86 or 2/3/86	480	48 mm	24,000	Garden Bar Road
Spring-run chinook salmon	Feather R. FH	2/20/85	344	54 mm	77,400	Gladding Road

*Length estimates from Fish Hatchery Management, Fish and Wildlife Service, 1992.

3. Adult Spawning Timing, Distribution, and Population Estimates

- **1964 Fall-run Chinook Salmon Spawning Survey by Eric Gerstung:** Gerstung noted that fish moved upstream after rains on October 30, 1964. Spawning was 80% complete by November 23, 1964. Fish and Game wardens reported that many fish had been poached before the survey started [this statement is probably not particularly relevant to Doty Ravine because of the low estimated adult spawning run of 10 fish]. Gerstung notes that the spawning runs were similar to 1963, but no data on the 1963 runs were found in the files examined. Gerstung surveyed 5,000 linear feet of stream, on November 23, 1964 near the Garden Bar Road Bridge [See figure below] and found 1 live fish and 1 carcass. Small x's indicate salmon spawning survey areas and other text indicates areas where spawning gravels were present. The water was reported clear, with flow estimated at 15 cfs. **Source: May 25, 1965 memorandum in CDFG, Region 2**



files.

- **December 6, 1985 Spawning Survey:** Three locations on Doty Ravine were surveyed for fall-run chinook salmon on 12/6/85. No specific locations were documented. No fish or redds were observed. Flow was estimated at 10 cfs. **Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.**

- **Fall 1958 Anecdotal Report:** Unidentified rancher reported fall-run chinook salmon in Doty Ravine to an unknown Fish and Game employee in March of 1959. **Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.**

- **Warden's Patrol Report:** Fish and Game Warden Wayne Caldwell reported seeing 37 [fall-run?] chinook salmon in Doty Ravine prior to November 10th of an unidentified year. **This observation is probably based on a 1979 warden's report, which has Warden Caldwell's signature.**

4. Juvenile Distribution and Sampling Data

- **March 3, 1959 Electrofishing Survey:** No specific location is reported. Unknown author reports small rainbow trout population. The following fish species were captured by electrofishing an unknown length of stream:

  2 rainbow trout (8-10 inches in length)
  "few" brown trout
  suckers (up to 24 inches in length)
  catfish

  Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.

- **Spring 1965 Fall-run Chinook Juvenile Emigration Survey by Eric Gerstung:** Gerstung began trapping downstream migrant fall-run chinook juveniles on 2/24/1965 and continued through 3/17/1965. Trap location is reported as T 13 N, R 6 E, S 34, NW1/4 of NE1/4; approximately 100 yards downstream of "Gladding Clay Pit Road" on the left bank [Review of the topographic map indicates that this site was located approximately 100 yards downstream of the Gladding Road crossing over Doty Ravine. Sampling was with a "riffle" trap or perforated plate trap, which covered 7ft of the 22ft. width of the channel. The trap fished a total of 503.5 hours and captured 2 juvenile chinook salmon. Water clarity was recorded as clear for each day [11 days] the traps were checked over this time period. Water temperatures were recorded at the time the traps were checked and are reported above, in the water temperature section of this report. Gerstung notes: "Most salmon are believed to have remained in the stream above the traps during the sampling period" [General statement regarding all of the streams surveyed}. No other fish species catch composition data is reported. **Source: May 25, 1965 memorandum in CDFG, Region 2 files, handwritten draft of May 25, 1965 memo, and other handwritten notes.**

- **1984 Seining and Electrofishing for Native Brood Year 1983 Fall-run Chinook Salmon:** Water temperatures for this sampling effort are reported above. The following sampling results are reported for this sampling effort. **Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.**

Date	Effort	No. Chinook	Length Mode (mm)	Length Range (mm)	Other Fish Species	Location
2/28/84	2 seine hauls	4	40	40-44	1 – tule perch 3-squawfish*	McCourtney Road
2/28/84	2 seine hauls	4		35-44		Garden Bar Road
3/27/84	100-200' electrofish.	0				McCourtney Road
5/2/84	2 seine	1		97	3-squawfish*	McCourtney

	hauls	1 – sucker	Road

***** Sacramento squawfish are now known as Sacramento pikeminnow.
Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.

F. Fish Passage or Screening Data

This section of the report documents known fish passage or screening needs. Immediately below are brief discussions of the two man structures that may be fish passage impediments or barriers under certain flows or operational conditions. Following these assessments is a discussion of water flows and beaver activities, which may preclude anadromous fish from reaching these two structures under adverse flow conditions.

1. Doty Ravine, NID Doty Ravine South Diversion Structure (Assessment by Randy Bailey, based on an on-site visit and discussions with NID staff)

This structure was not included in the evaluation of diversion structures during the completion of the Auburn Ravine/Coon Creek Ecosystem Restoration Plan

- **Location:** This structure is located on Doty Ravine approximately ¼ to ½ mile downstream of Crosby Herold Road.

- **General Description:** This diversion is a U-shaped concrete structure with abutments and sidewalls approximately 6 feet high with a concrete bottom. An inlet into a canal is situated on the south bank of the channel and consists of concrete headworks with a trash rack. The bottom of the structure is relatively flat with an approximately 6-foot apron downstream of the flashboard location. Downstream of the apron, a boulder field approximately 20-30 feet long has been placed to stop water from scouring underneath and undermining the concrete apron. Flashboards are installed at the beginning of the irrigation season (about April 15 in most years) and removed at the end of the season (about mid-October). During the irrigation season, little flow is allowed downstream of this point.

- **Assessment:** Given the general season of operation, under moderate to high flows, this diversion structure does not present a problem for adult anadromous fish migrating upstream to spawn. Under lower flows (unquantified at this time) the boulder field immediately downstream of the apron would become a passage barrier for adults. However, under lower flows, it may be impossible for adults to even reach this location from downstream because of lack of water depth or other passage impediments such as beaver dams. Also, the headworks for the canal are unscreened and juveniles could be diverted into the canal.

  Since the water diversions at this site do not generally begin until mid-April it is possible that juveniles moving downstream of this location would be killed by high water temperatures in Coon Creek or the Eastside/Cross canals before they could reach the Sacramento River. However, insufficient water temperature monitoring data exists to reach a conclusion one way or another. In years of high runoff and/or a cool spring, it may be possible for juveniles to emigrate successfully. Also, during years of high late-spring runoff, the diversion would not be operated in mid-April. It is also important to note that actively emigrating smolts could easily transit the distance from this diversion site to Coon Creek in as little as one day. Fall-run chinook salmon have been documented spawning upstream of this location.

2. Doty Ravine, Garden Bar Road Culvert (adapted from the Auburn Ravine/Coon Creek Ecosystem Restoration Plan; analysis by James Buell, PhD)

- **Location:** The Garden Bar Road crossing of Doty Ravine

- **General Description:** The Garden Bar Road crossing of Doty Ravine consists of a masonry and fill road prism extending across the stream channel with a 12 ft diameter round culvert. The culvert is sloped at about 2% and is perched about 4 ft above the low flow water surface of a large scour hole immediately downstream of the road fill. This scour hole is used as a "swimming hole" by local residents, and extends about 100 ft downstream to a gravel tail bar. The active stream channel is well over 100 ft wide downstream of the scour hole and is depositional in nature. Bed materials are primarily sand and fine gravel, with gravel and cobbles in the thalwag. Banks are composed of fine materials and are erodible.

- **Assessment:** The perched nature of the culvert and its slope combine to make this crossing an effective adult anadromous fish migration barrier at all but flows high enough to backwater the culvert invert. The very wide control of the scour hole downstream indicates that backwatering would only be achieved under very high stream flows. Given the length and slope of the culvert, it is possible that some aggressive steelhead could negotiate this crossing under less-than-backwatering stream flows, but it is likely that most fish would not.

- **Priority for Attention:** High.

- **Alternative approaches:** Several alternatives are available for achieving good fish passage conditions under most stream flows at the Garden Bar Road crossing of Doty Ravine:

  (a) ***Culvert replacement with a bridge.*** This approach would involve removing most or all of the masonry and fill road prism across the Doty Ravine stream corridor and replacing it with a formal bridge structure. Advantages of this approach are good passage conditions under virtually all stream flows during which adult anadromous fish are migrating with little or no maintenance other than standard bridge maintenance. Disadvantages include very high cost and eventual disappearance of the "swimming hole."

(b) ***Culvert replacement with an arch culvert.*** This approach is similar to the first alternative, except it would require less demolition of the existing road prism. The arch should be large enough to convey flood flows without foundation scour. A "natural" streambed bottom would be maintained, perhaps with some scour to large pavement materials (large cobbles, boulders), and concrete footings would be required to prevent undermining. Advantages of this approach include good passage conditions under the great majority of stream flows during which adult anadromous fish are migrating, with little or no maintenance other than standard arch culvert maintenance. Disadvantages include high cost and eventual disappearance of the "swimming hole".

(c) ***Culvert replacement with a larger elliptical culvert.*** This approach is similar to the second alternative, except it would not require concrete footings (although the culvert would still have to be sealed). Culvert size should be established through an engineering analysis, but would probably be about 16 ft on the vertical axis. The invert of the culvert should be submerged for its entire length under low flow conditions. Advantages of this approach include elimination of bed scour under the road crossing and good passage conditions under the great majority of stream flows during which adult anadromous fish are migrating with little or no maintenance other than standard culvert maintenance. Disadvantages include high cost and probably eventual reduction in size of the "swimming hole".

(d) ***Backwater culvert with a series of box weirs.*** This approach would involve construction of a series of low box weirs extending downstream from the mouth of the culvert. Dimensions of the series should be established by an engineering analysis, but the entire footprint may be on the order of 30 ft wide by 50 ft long (downstream direction). Each box weir should have three rectangular notches (approximately 24 in wide x 10 in deep) to concentrate flow at moderate stream discharge, one on each side and one in the downstream end. Notches should be staggered rather than aligned. The elevation of the invert of the notches upstream-most box weir should not be more than 1 ft below the elevation of the invert of the existing culvert. It is likely that three box weirs will be required, but it is possible that two will be sufficient. Advantages of this approach include good passage conditions under most stream flows during which adult anadromous fish are migrating with little or no maintenance and relatively modest cost. Disadvantages include potential reduction of conveyance capacity of the existing culvert and significant encroachment into the existing "swimming hole."

(e) ***Construct Alternative 4 using gabions.*** This approach is essentially identical to Alternative 4 except that gabions (rock-filled wire baskets) would be used to construct the box weirs. Advantages include those associated with Alternative 4 and lower cost. Disadvantages include periodic maintenance and repair and safety risk associated with sharp broken wires in an area actively used by children for water-oriented recreation.

(f) ***Backwater culvert with a series of low "V" weirs.*** This approach would involve construction of a series of low, shallow-angle "V" weirs across the entire Doty Ravine stream corridor and reinforcing (armoring) stream banks in the vicinity of each weir (possibly the entire project area). The angle of the "V" in each weir should be sufficient to concentrate flows near the center of the channel; however the series should be staggered off the channel centerline by about 8-10 ft. The elevation of the invert (center of the "V") of the upstream-most weir should be not more than 1 ft below the elevation of the invert of the culvert. It is likely that three weirs would be required. Advantages of this approach include good passage conditions under most flows during which adult anadromous fish are migrating with little or no maintenance and probably insignificant reduction in conveyance capacity of the existing culvert (an engineering analysis of this parameter should be performed, however). Disadvantages include significantly higher cost than the fourth alternative (see above), potential bank scour and very extensive "modification" of the "swimming hole".

- **Recommendation:** Perform hydraulic and cost analyses on the third and fourth alternatives, above (culvert replacement with elliptical culvert, submerged invert; series of notched box weirs). Select and implement the most cost-effective approach meeting appropriate engineering and conveyance criteria.

3. Water Flows

Fall and winter water flows are particularly important in Doty Ravine. Because water deliveries are curtailed, generally before fall-run chinook salmon attempt to migrate upstream to spawn, the depth of water in the channel can be insufficient to provide adult passage. Adult chinook salmon and steelhead need approximately 1$\pm$ foot of water depth with some resting pools in order to migrate upstream. Transit time for adult fish from the Coon Creek confluence to upstream of Crosby Herold Road could routinely be accomplished in one day. However, adequate water depth is critical and should be taken into consideration concurrently with any fish passage projects for this drainage.

4. Beaver Dams

Beaver dams and beaver activity in general hinder adult anadromous fish passage in this watershed. During the stream videography project, six major beaver dams were documented from the air, between the confluence with Coon Creek and an area upstream of the Wise Road crossing on March 12, 2003. During the fall/winter of 2002/2003, major beaver dams were located within 100 feet of the Crosby Herold and Wise Road crossings. These dams remained in place and blocked adult fish passage for the entire spawning season for both fall-run chinook salmon and steelhead, with the possible exception of part of one day at the Crosby Herold Bridge. There may have been other passage problems related to beaver activity further downstream that would render the problems at upstream locations moot.

APPENDIX DOTY RAVINE 1

BENTHIC MACROINVERTEBRATE DATA
COLLECTED BY THE AUBURN RAVINE CITIZENS GROUP

PHYLUM			**12/01/00**			**10/01/01**		
Class			**Doty Ravine @ Garcia**			**Doty Ravine @ Garcia**		
Order								
Family			**A**	**B**	**C**	**A**	**B**	**C**
Genus species	**TV[1]**	**FFG[2]**						
ARTHROPODA								
Hexapoda								
Coleoptera (Larvae)								
Elmidae	5	cg				1		
Psephenidae	4	sc						
Diptera								
Chironomidae	6	cg	4	1	4	30	19	17
Empididae	6	p	4	3		3		
Simuliidae	6	cf	1	6	2	1	5	2
Tipulidae	3	sh						
Ephemeroptera								
Baetidae	4	cg	9	19	14	12	28	24
Ephemerellidae	1	cg	1					
Leptohyphidae	4	cg	19	14	29	5	5	11
Plecoptera								
Capniidae	1	sh		2	1			
Chloroperlidae	1	p	2	7				
Perlodidae	2	p	5	9	3	1		2
Trichoptera								
Brachycentridae	1	ot				1		
Glossosomatidae	0	sc	3	4	4		1	1
Hydropsychidae	4	cf	22	17	17		2	
Hydroptilidae	4	ot				3	6	1
Leptoceridae	4	ot						
Philopotamidae	3	cf					1	1
Lepidostoma								
Pyralidae	5	sc	2					
Odonata								
Coenagrionidae	9	p						
Gomphidae	4	p	2	5	3	3	5	3
Libellulidae	9	p	2	3	7	1	3	
Subphylum Chelicerata								
Arachnoidea								
Hydracarina (=Acari)	5	p	1	1		3		2
Subphylum Crustacea								
Malacostraca								
Amphipoda	4	cg	4	1	6	3	2	2

MOLLUSCA								
Gastropoda								
Limnophila								
Planorbidae	6	sc				3	3	
Bivalvia								
Pelecypoda								
Corbiculacea	10	cf					3	2
NEMATODA	5	p		1		2	1	1
NEMERTEA			11	5		4		2
PLATYHELMINTHES								
Turbellaria								
Tricladida								
Planariidae	4	p						
ANNELIDA								
Oligochaeta	5	cg	1	6	4	10	15	17
		Total Macroinvertebrates:	**93**	**104**	**94**	**86**	**99**	**88**
[1] **TV: Tolerance Values**								
[2] **FFG: Fuctional Feeding Groups**								
Taxonomic Richness			17	17	12	17	15	15
EPT Taxa			7	7	6	5	6	6
Ephemeroptera Taxa			3	2	2	2	2	2
Plecoptera Taxa			2	3	2	1	0	1
Trichoptera Taxa			2	2	2	2	4	3
EPT Index			66	69	72	26	43	45
Sensitive EPT Index			12	21	9	2	2	5
Tolerance Value			3.5	3.6	4.3	4.9	5.0	4.6
Percent Intolerant Organisms			12	21	9	2	2	5
Percent Tolerant Organisms			2.2	2.9	7.4	1.2	6.1	2.3
Percent Dominant Taxon			24	18	31	35	28	27
Percent Collectors			41	39	61	71	70	81
Percent Filterers			25	22	20	1	11	6
Percent Grazers			5	4	4	3	4	1
Percent Predators			17	28	14	15	9	9
Percent Shredders			0	2	1	0	0	0
Other			0	0	0	5	6	1

PHYLUM						12/01/00			10/01/01		
	Class					**Doty Ravine @**			**Doty Ravine @**		
		Order				**Garcia**			**Garcia**		
			Family		***Site Code:***	**A**	**B**	**C**	**A**	**B**	**C**
				TV[1]	**FFG**[2]						
ARTHROPODA											
	Hexapoda										
		Coleoptera (Larvae)									
			Elmidae	5	cg				1		
			Psephenidae	4	sc						
		Diptera									
			Chironomidae	6	cg	4	1	4	30	19	17
			Empididae	6	p	4	3		3		
			Simuliidae	6	cf	1	6	2	1	5	2
			Tipulidae	3	sh						
		Ephemeroptera									
			Baetidae	4	cg	9	19	14	12	28	24
			Ephemerellidae	1	cg	1					
			Leptohyphidae	4	cg	19	14	29	5	5	11
		Plecoptera									
			Capniidae	1	sh		2	1			
			Chloroperlidae	1	p	2	7				
			Perlodidae	2	p	5	9	3	1		2
		Trichoptera									
			Brachycentridae	1	ot				1		
			Glossosomatidae	0	sc	3	4	4		1	1
			Hydropsychidae	4	cf	22	17	17		2	
			Hydroptilidae	4	ot				3	6	1
			Leptoceridae	4	ot						
			Philopotamidae	3	cf					1	1
		Lepidostoma									
			Pyralidae	5	sc	2					
		Odonata									
			Coenagrionidae	9	p						
			Gomphidae	4	p	2	5	3	3	5	3
			Libellulidae	9	p	2	3	7	1	3	
Subphylum Chelicerata											
	Arachnoidea										
		Hydracarina (=Acari)		5	p	1	1		3		2
Subphylum Crustacea											
	Malacostraca										

		Amphipoda			4	cg	4	1	6	3	2	2
MOLLUSCA												
	Gastropoda											
		Limnophila										
			Planorbidae		6	sc				3	3	
	Bivalvia											
		Pelecypoda										
			Corbiculacea		10	cf					3	2
NEMATODA					5	p		1		2	1	1
NEMERTEA							11	5		4		2
PLATYHELMINTHES												
	Turbellaria											
		Tricladida										
			Planariidae		4	p						
ANNELIDA												
	Oligochaeta				5	cg	1	6	4	10	15	17
						Total	**93**	**104**	**94**	**86**	**99**	**88**
[1] **TV: Tolerance Values**												
[2] **FFG: Functional Feeding Groups**												

	12/01/00			10/01/01		
	Doty Ravine @ Garcia			Doty Ravine @ Garcia		
	Mean	**SE**	**CST**	**Mean**	**SE**	**CST**
Taxonomic Richness	15	1.7	19	16	0.7	21
EPT Taxa	7	0.3	8	6	0.3	8
Ephemeroptera Taxa	2	0.3	3	2	0.0	2
Plecoptera Taxa	2	0.3	3	1	0.3	1
Trichoptera Taxa	2	0.0	2	3	0.6	5
EPT Index (%)	69	2.0	69	38	6.3	38
Sensitive EPT Index (%)	14	3.8	14	3	0.8	3
Dominant Taxon (%)	24	3.6	21	30	2.4	24
Tolerance Value	3.8	0.2	3.8	4.8	0.1	4.8
Intolerant Organisms (%)	14	3.8	14	3	0.8	3
Tolerant Organisms (%)	4.2	1.7	4.1	3.2	1.5	3.3
Collectors (%)	47	6.8	47	74	3.5	74
Filterers (%)	22	1.3	22	6	2.9	6
Grazers (%)	4	0.5	4	3	0.9	3
Predators (%)	20	4.2	20	11	2.0	11
Shredders (%)	1	0.6	1	0	0.0	0
Other (%)	0	0.0	0	4	1.5	4
* Site statistics based on small and variable sample sizes						

	12/01/00			**10/01/01**		
	Doty Ravine @ Garcia			**Doty Ravine @ Garcia**		
	DRG-A	**DRG-B**	**DRG-C**	**DRG-A**	**DRG-B**	**DRG-C**
Taxonomic Richness	17	17	12	17	15	15
EPT Taxa	7	7	6	5	6	6
Ephemeroptera Taxa	3	2	2	2	2	2
Plecoptera Taxa	2	3	2	1	0	1
Trichoptera Taxa	2	2	2	2	4	3
EPT Index (%)	66	69	72	26	43	45
Sensitive EPT Index (%)	12	21	9	2	2	5
Dominant Taxon (%)	24	18	31	35	28	27
Tolerance Value	3.5	3.6	4.3	4.9	5.0	4.6
Intolerant Organisms (%)	12	21	9	2	2	5
Tolerant Organisms (%)	2.2	2.9	7.4	1.2	6.1	2.3
Collectors (%)	41	39	61	71	70	81
Filterers (%)	25	22	20	1	11	6
Grazers (%)	5	4	4	3	4	1
Predators (%)	17	28	14	15	9	9
Shredders (%)	0	2	1	0	0	0
Other (%)	0	0	0	5	6	1
*** Sample size less than 50 organisms**						

DRY CREEK

A. Water Quality Data

1. 1979 August to October Grab Sampling in Dry Creek. Water quality samples were collected from Dry Creek, upstream of the Roseville Wastewater Treatment Plant on four dates during the period August to October 1979. This survey reported (Table 1) the following results. **Source: DEIR Northeast Roseville Specific Plan 1986.**

Table 1. Water quality data from August to October 1979 grab sampling in Dry Creek, upstream of the Roseville Wastewater Treatment Plant.

Parameter Sampled	8/29/79	9/20/79	10/3/79	10/16/79
pH	7.4	--	7.0	--
Water Temperature (^{O}C)	21.0	20.0	18.0	19.0
Time Sampled	0625	1025	1015	1230
Dissolved Oxygen (mg/l)	7.2	9.2	8.7	8.5
Nitrate (mg/l as N)	0.06	--	0.02	--
Nitrite (mg/l as N)	<0.01	--	<0.01	--
Total NH_3 (mg/l as N)	0.13	--	0.30	--
TKN (mg/l as N)	0.55	--	0.61	--
Total Phosphate (mg/l as P)	--	--	0.16	--
Orthophosphate (mg/l as P)	--	--	0.16	--

Source: DEIR Northeast Roseville Specific Plan 1986.

2. Summary of 1989 and 1990 Water Quality Sampling Upstream of the City of Roseville Wastewater Treatment Plant Outfall: This data (Table 2) appears to be a summary of the monitoring requirements for the City of Roseville's NPDES permit for this facility. The data parameters measured are typical of NPDES monitoring requirements in this area. If this assumption is true, then additional data for all of the years monitoring has been required by the NPDES permit should be available. This type of data usually involves a single event sample collected on selected days during the year. The number of samples collected varies by constituent and between years. These data are of limited use in analyzing general conditions in the watershed. For the data in Table 2, sample sizes range from 52-79 and 44-124, depending on the constituent, for 1989 and 1990, respectively. **Source: City of Roseville, Roseville Regional Wastewater Treatment Service Area Master Plan DEIR, 1996.**

Table 2. Maximum, minimum, and mean values for selected water quality parameters from Dry Creek, upstream of the wastewater treatment plant outfall, during 1989 and 1990.

Year	Stream Flow (cfs)	Dissolved Oxygen (mg/l)	pH	Water Temp. (^oC)	Turbidity (NTU)	Un-ionized Ammonia (mg/l)
1989						
Maximum	387.0	13.2	7.9	17.9	48.0	0.028
Mean	43.9	9.6	7.4	10.8	5.6	0.003
Minimum	17.0	7.0	6.7	3.5	1.2	0.000
1990						
Maximum	235.0	12.5	7.9	28.5	28.0	0.000
Mean	46.9	9.1	7.4	14.9	6.6	0.001
Minimum	3.0	4.8	6.5	3.4	1.3	0.000

Source: City of Roseville; Roseville Regional Wastewater Treatment Service Area Master Plan DEIR, 1996.

3. Dry Creek Conservancy and Central Valley Regional Water Quality Control Board Monitoring Data 2000-2003: The DCC and CVRWQCB members and staff have conducted a variety of monitoring programs and single-time event monitoring at various locations in the Dry Creek Watershed. The data presented here represents only that data collected on the mainstem of Dry Creek and does not include any tributary streams. Only selected parameters, generally more important to anadromous fish, have been analyzed and results presented below.

One of the parameters of concern is the seasonal and often rapid change in pH at various stations. This unexplained pattern has been observed in other watersheds as well. Two examples of rapid and significant fluctuation in measured pH are shown on Figures 1 and 2 to illustrate the situation. Figure 1 shows monthly data from samples at Atkinson Street in Roseville. Notice the magnitude of changes over relatively short periods of time. Figure 2 shows a composite graph for four locations in Dry Creek, including the Atkinson Street site. The same pattern appears.

Figure 1. Monthly pH data at Atkinson Street in Roseville during 2001. Note the magnitude of fluctuations in monthly time increments.

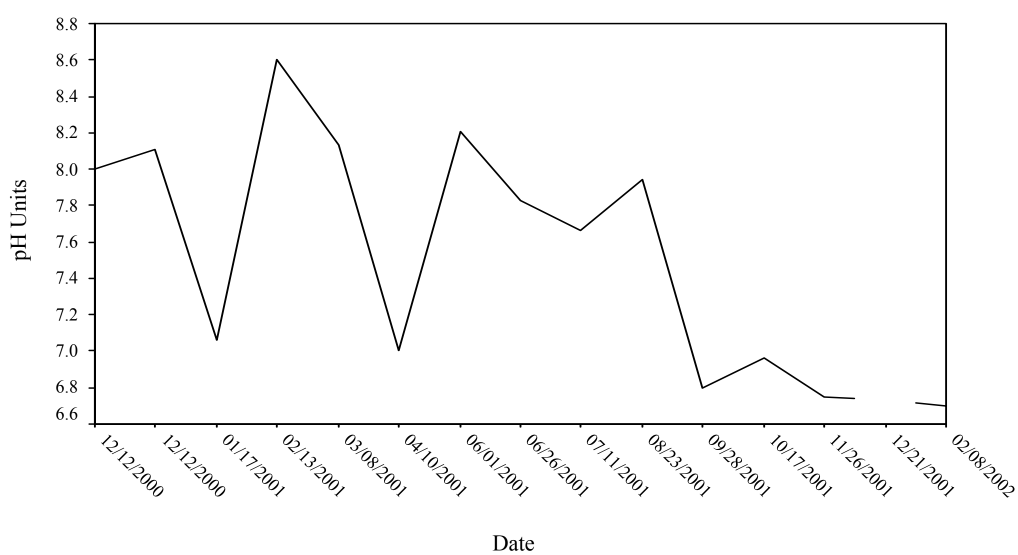
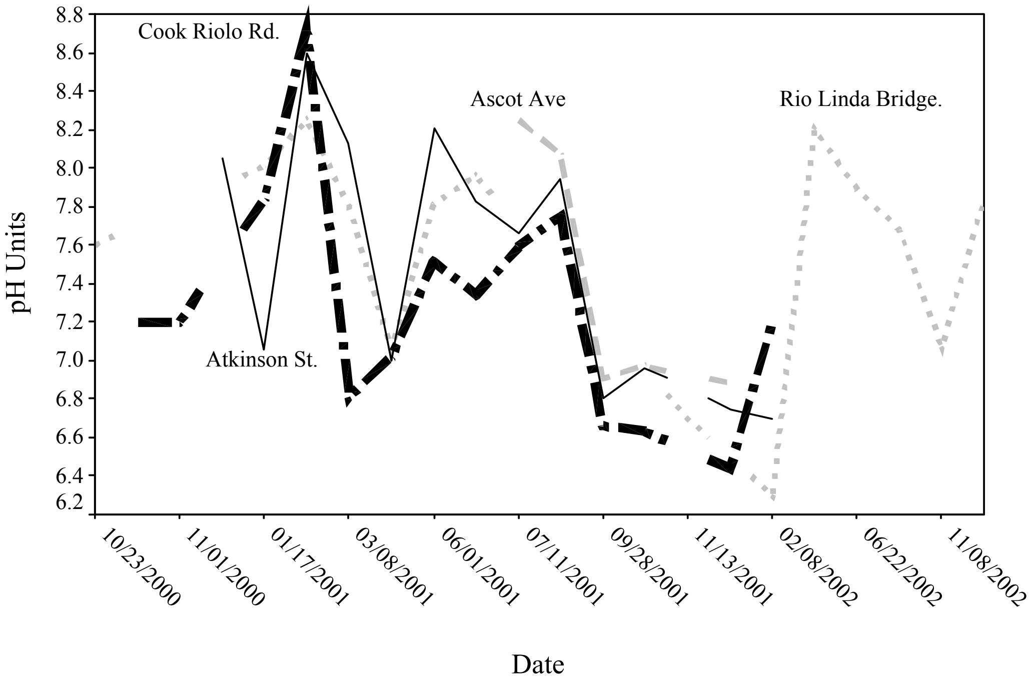


Figure 2. Monthly and quarterly pH values from four sites in the Dry Creek mainstem within and downstream of the City of Roseville. Note the magnitude and rate at which relatively large changes are occurring.



Other water quality parameters of concern include nitrate and orthophosphate. Figure 3 displays data from the Rio Linda Bridge area and shows extremely high levels of both constituents and a nutrient ratio that is out of balance. Normally a ratio of nitrate to orthophosphate of 10:1 is desirable in anadromous fish streams, with nitrate levels not exceeding 1.0 mg/l. Figure 4 displays data from sites in Royer and Saugstedt parks in the City of Roseville and shows high concentrations and an out-of-balance condition.

Figure 3. Nitrate and orthophosphate data from the Rio Linda Bridge area of Dry Creek. Note the high concentrations of each constituent and the ratio between the two concentrations.

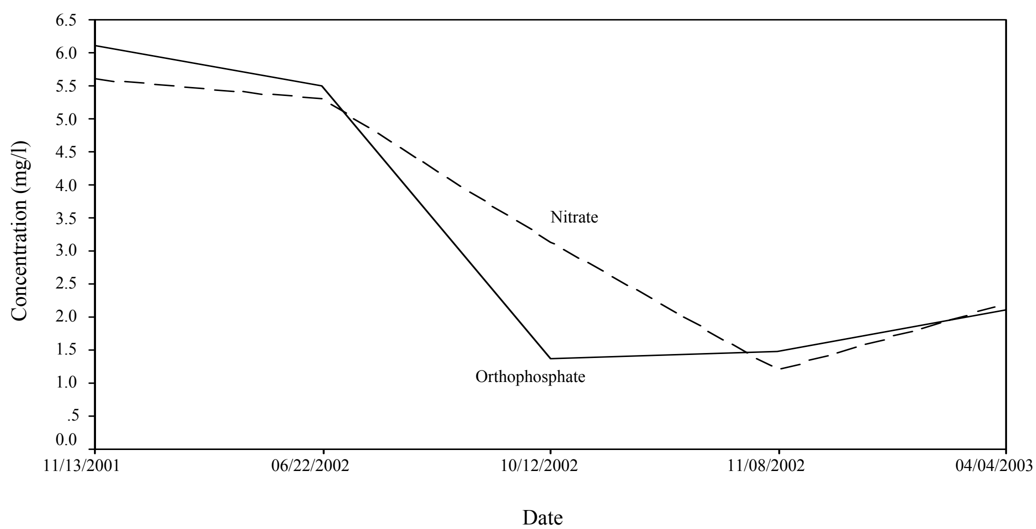
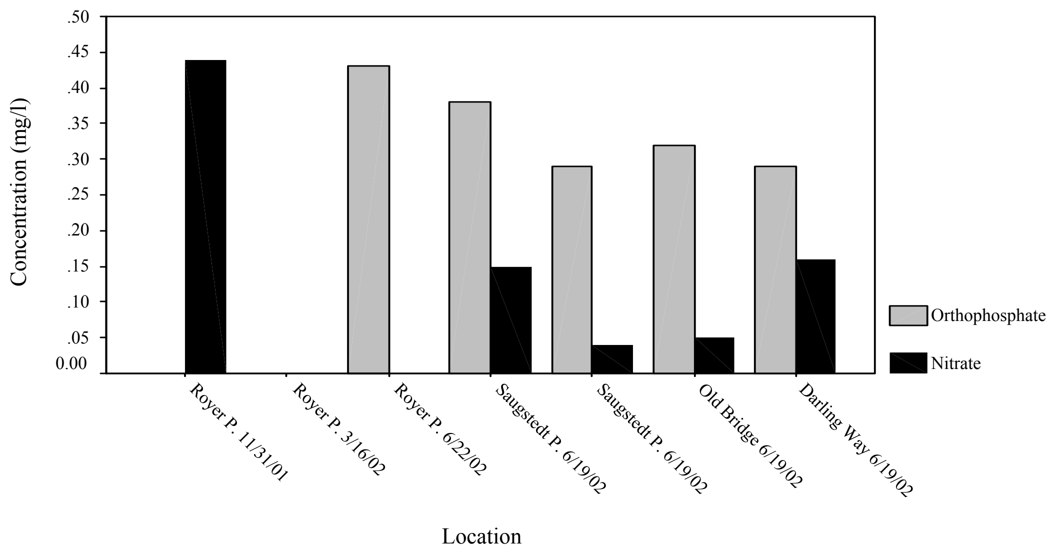


Figure 4. Nitrate (3 dates) and orthophosphate (2 dates) data at Royer Park in Roseville and data from four locations between Darling Way and Saugstedt Park on the same date (6/19/02). Note the relatively low concentrations of nitrate, but the ratio between nitrate and orthophosphate is out of balance. This graph shows that additions of nitrate to the system could cause additional plant growth, with orthophosphate not limiting.



It is probable that additional data are available for other locations in the Dry Creek Watershed, downstream of the confluences with Antelope Creek and both Secret and Miners ravines. However, I have focused on the data that characterize the mainstem of Dry Creek where anadromous fish use probably is concentrated. I have not attempted to collect data for the Linda/Cirby Creek watersheds since they are outside the area under consideration for the HCP. Also, I assumed that Dry Creek begins at the confluence of Secret Ravine and Miners Ravine. Different maps describe the reach between the confluence of Cirby Creek, near Riverside Drive, and upstream to the confluence of Antelope Creek and/or Secret/Miners differently.

In addition to the pH and nutrient data presented above, information on heavy metals has been collected at two locations and dates in the mainstem of Dry Creek. Table 3 displays the California Toxics Rule water quality standards for selected metals. Table 4 displays the data from Dry Creek, which shows that all samples for copper exceeded the water quality standards (note: the standards are for a hardness of 50 mg/l, while the actual hardness fluctuates between about 40-100 mg/l). Two of the three zinc concentrations exceeded the standards. In addition to these metals, one sample from Royer Park contained a concentration of 0.028 mg/l of vanadium, which has no published standard and one sample from the Rio Linda Bridge contained 0.012 mg/l of chromium, but no valence was reported, thus it is impossible to compare this concentration to published standards. **Sources: Central Valley Regional Water Quality Control Board; Dry Creek Conservancy, unpublished data.**

Table 3. California Toxics Rule water quality standards for selected metals, based on a hardness of 50 mg/l as CaCO3.

Metal	Maximum Concentration (Acute) (mg/L)	Continuous Concentration (Chronic) (mg/L)
Barium	No standard	No standard
Cadmium	0.002	0.0013
Copper	0.007	0.005
Zinc	0.067	0.066

Source: California Toxics Rule (water quality objectives)

Table 4. Metal concentration data from two locations in the Dry Creek Watershed. This data shows that copper and zinc concentrations exceed the California Toxics Rules standards calculated for a hardness of 50 mg/l as CaCO3.

Stream	Location	Date	Barium mg/l	Copper mg/l*	Zinc mg/l	Notes
Dry Creek	Royer Park	11/13/01	0.160	**0.024**	**0.100**	Hardness ≈ 50-100 mg/L
Dry Creek	Rio Linda Bridge	11/13/01	---	**0.006**	0.046	Hardness ≈ 60 mg/L
Dry Creek	Rio Linda Bridge	11/08/01	---	**0.015**	**0.067**	Hardness ≈ 60-100 mg/L

* Values in bold exceed California Toxics Rule objectives for aquatic life at a hardness of 50 mg/L.
Sources: Central Valley Regional Water Quality Control Board; Dry Creek Conservancy, unpublished data.

B. Water Temperature Data

Water temperature data for Dry Creek is limited to hourly recordings at two stations (Darling Way and Riverside Drive), and a single station, with recordings every two hours, just downstream of the confluence of Secret and Miners Ravine. CDFG Biologist Rob Titus has conducted monitoring at the Secret/Miners ravines confluence in conjunction with stream monitoring surveys. Only one year's data is currently available for this site, but additional data will become available in mid-December 2003. The temperature monitoring program at Darling Way and Riverside Drive includes seven other stations in the Cirby and Linda Creek watersheds and has not been included here. Data was obtained from Garcia and Associates, which is conducting the study for the City of Roseville. Data has been collected since 1998, but only the data presented in the figures below were available electronically. Since daily maximum, minimum, and/or mean temperatures individually are of little value, I have chosen to plot all data points. Therefore, I have split the year into time periods that roughly correspond to:

Fall-early winter: September though December; primary fall-run chinook salmon spawning period is November-December.
Winter-spring: January though April; fall-run chinook salmon incubation and rearing and steelhead spawning, incubation, and rearing.
Late spring-summer: May to September; summer rearing for steelhead juveniles.

Data plots for these time periods are presented below to allow the reader to assess the potential of Dry Creek to support chinook salmon and/or steelhead trout spawning and rearing. A variety of localized data and literature was reviewed, in order to gain a generalized understanding of the temperature effects on various life history stages for both chinook salmon and steelhead trout. There is fairly substantial variation in temperature effects noted for most life history stages. However, both chinook salmon and steelhead have an adaptable physiology and ability to seek thermal refuges, which allows them to tolerate and/or avoid lethal temperatures. Some of the literature sources cite criteria from others and some of the data is based on fish captures with water temperature taken concurrently. Two tables with data and reference are included in Appendix A of this report. Based on this review, the following criteria have been used to indicate what life history stages a particular stream may support at a given time:

Chinook Salmon	**^{O}C**	**Steelhead Trout**	**^{O}C**
Egg and fry development	14.4 (58 ^{O}F)	Egg and fry development	14.4 (58 ^{O}F)
Juvenile rearing	21.1 (70 ^{O}F)	Juvenile rearing	22.2 (72 ^{O}F)
Adult migration	21.7 (71 ^{O}F)	Adult migration and holding	22.2 (72 ^{O}F)

Reference lines for 14.4 ^{O}C and 22.2 ^{O}C are provided on Figures 5-16 to represent temperatures suitable for salmonid spawning migration, egg and fry development, and juvenile rearing.

1. Water Temperature Monitoring at the Confluence of Secret and Miners Ravines: Water temperatures were recorded at two-hour intervals. Data for the period July 30, 2002 to August 27, 2003 are presented in Figures 5-8 below. Additional data will be made available to Placer County when it becomes available. **Source: California Department of Fish and Game Biologist Rob Titus, unpublished data.**

Figure 5. Water temperature time series for Dry Creek at the confluence of Secret and Miners ravines, July 30 through August 31, 2002. Temperatures are suitable for juvenile rearing.

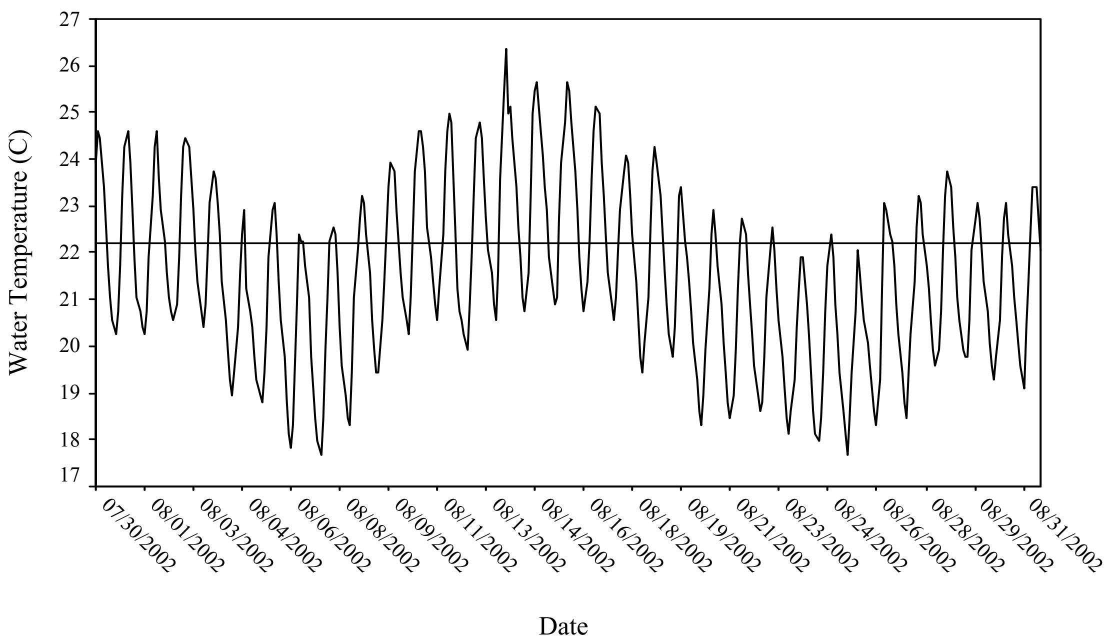


Figure 6. Water temperature time series, Dry Creek, confluence of Secret and Miners ravines, September 1 through December 31, 2002. Temperatures are suitable for juvenile rearing and adult spawning.
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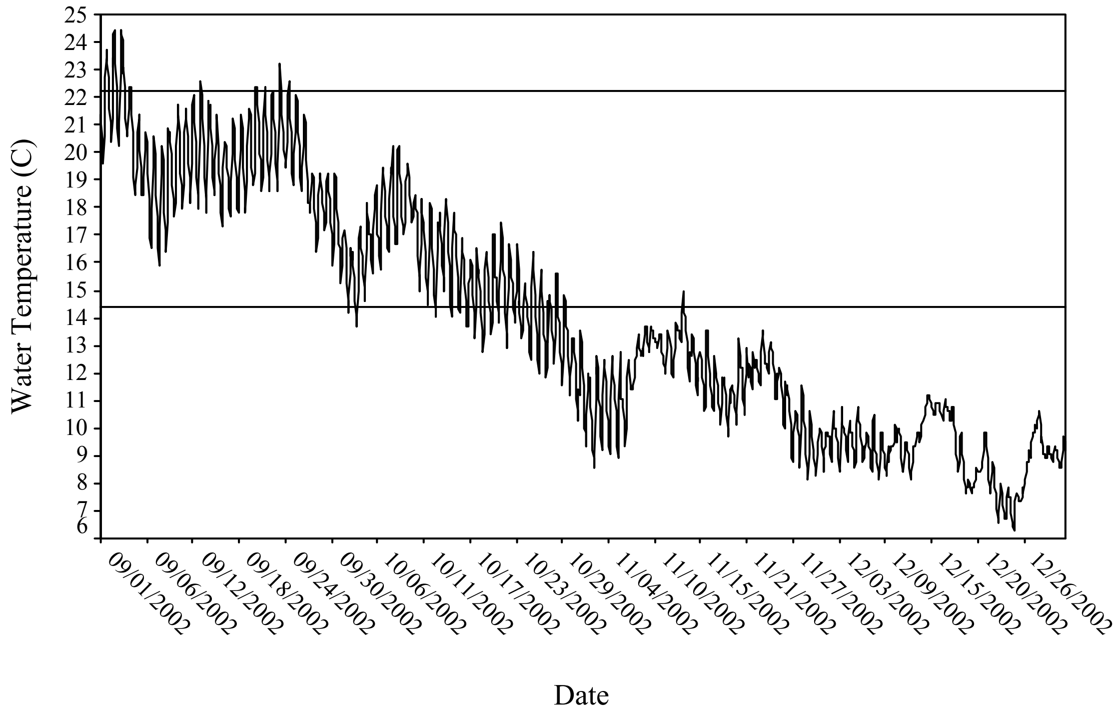


Figure 7. Water temperature time series, Dry Creek, confluence of Secret and Miners ravines, January 1 through April 30, 2003. Temperatures are suitable for juvenile rearing and adult spawning.

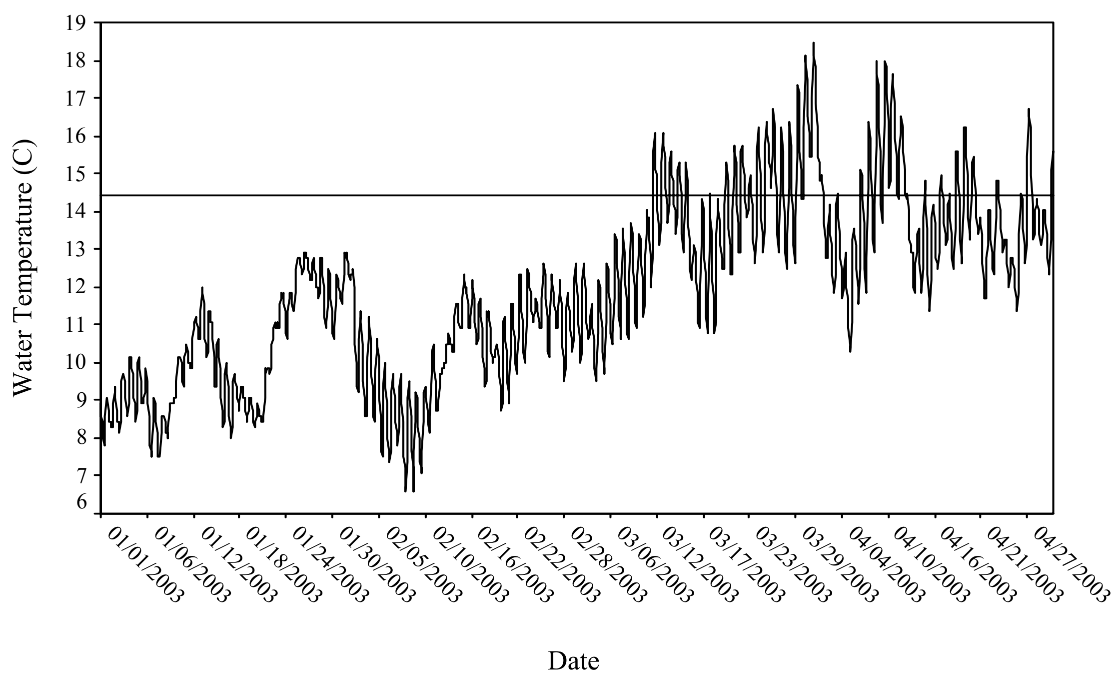
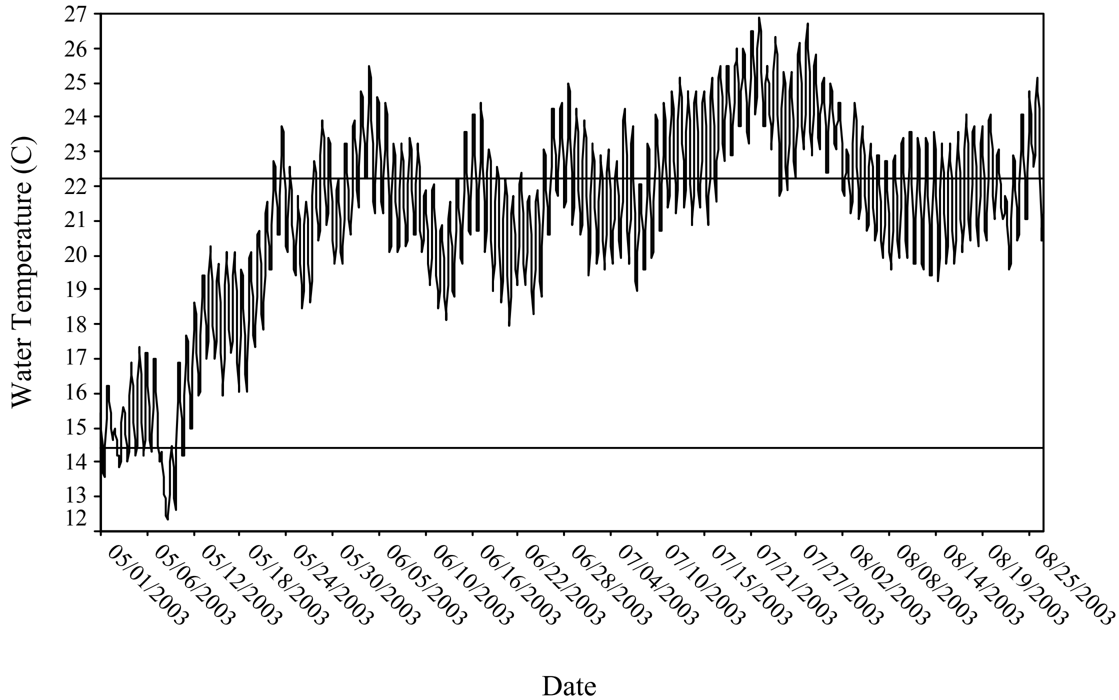


Figure 8. Water temperature time series for Dry Creek at the confluence of Secret and Miners ravines, during the period May 1 through August 27, 2003. Temperatures are suitable for juvenile rearing.



2. **Water Temperature Monitoring June 2001 through June 2002 at the Darling Way and Riverside Drive Stations:** Water temperature is recorded hourly at these two stations (Figures 9-16) as part of a larger monitoring effort by the City of Roseville. Only the data presented below was available electronically for this report. Additional data is available. **Source: City of Roseville (Garcia and Associates) data.**

Figure 9. Water temperature time series for Dry Creek at the Darling Way station, June 15 through August 31, 2001. Temperatures are not suitable for juvenile rearing.

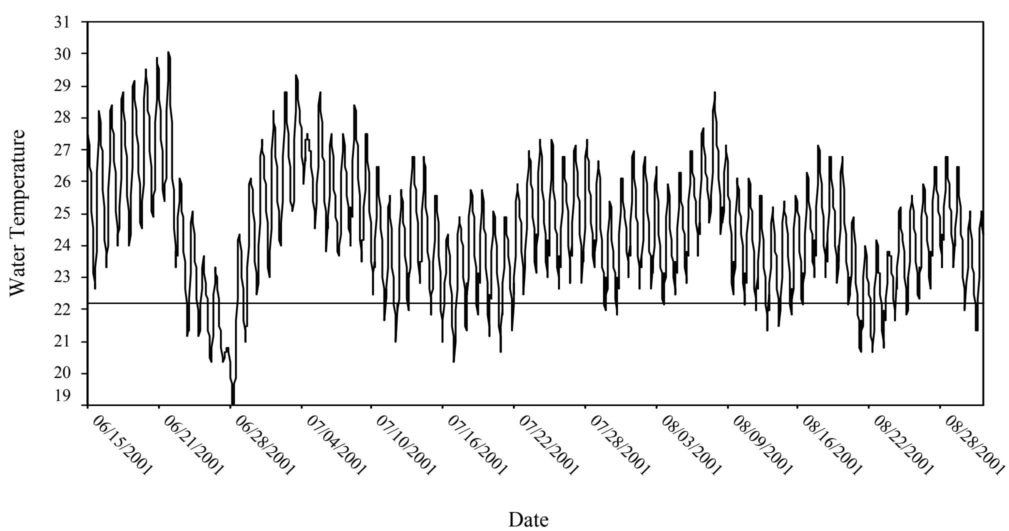


Figure 10. Water temperature time series for Dry Creek at the Darling Way station, September 1 through December 31, 2001. Temperatures become suitable for juvenile rearing in mid-September and adult spawning in late-October.

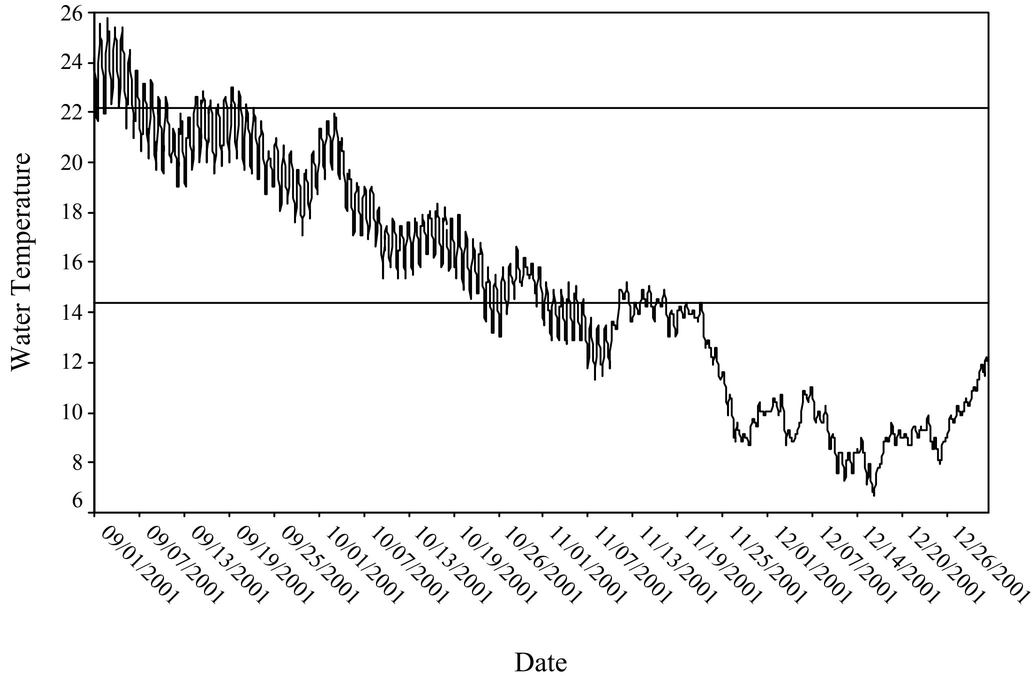


Figure 11. Water temperature time series for Dry Creek at the Darling Way station, January 1 through April 30, 2002. Temperatures are suitable for juvenile rearing throughout the entire period. Temperatures are suitable for incubation through about the end of March.

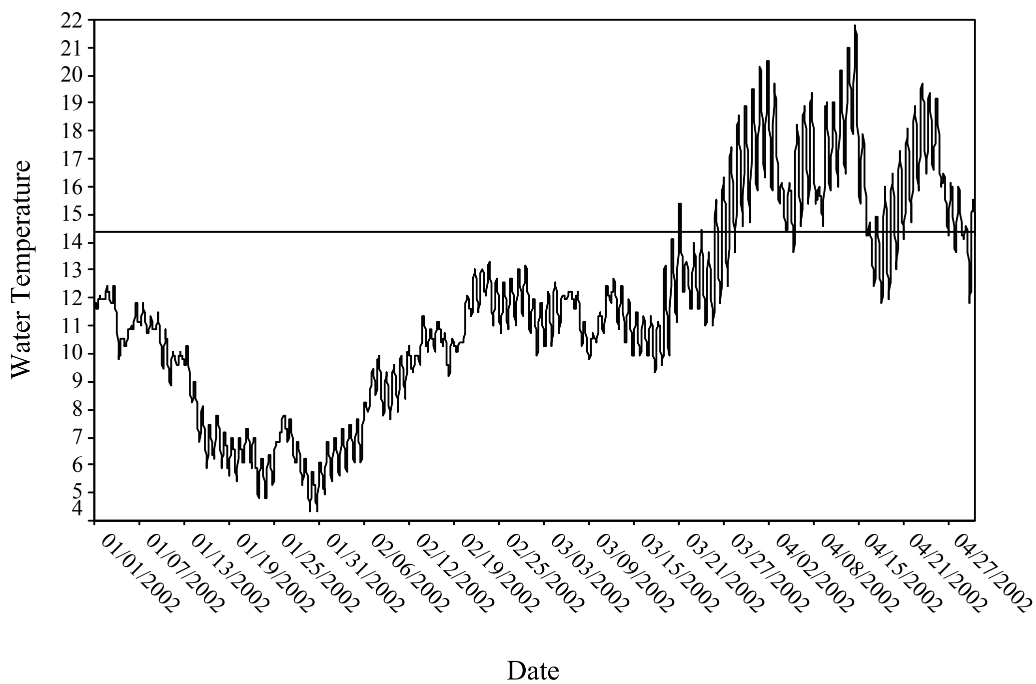


Figure 12. Water temperature time series, Dry Creek at the Darling Way station, May 1 through June 17, 2002. Temperatures are suitable for juvenile rearing for most of the period.

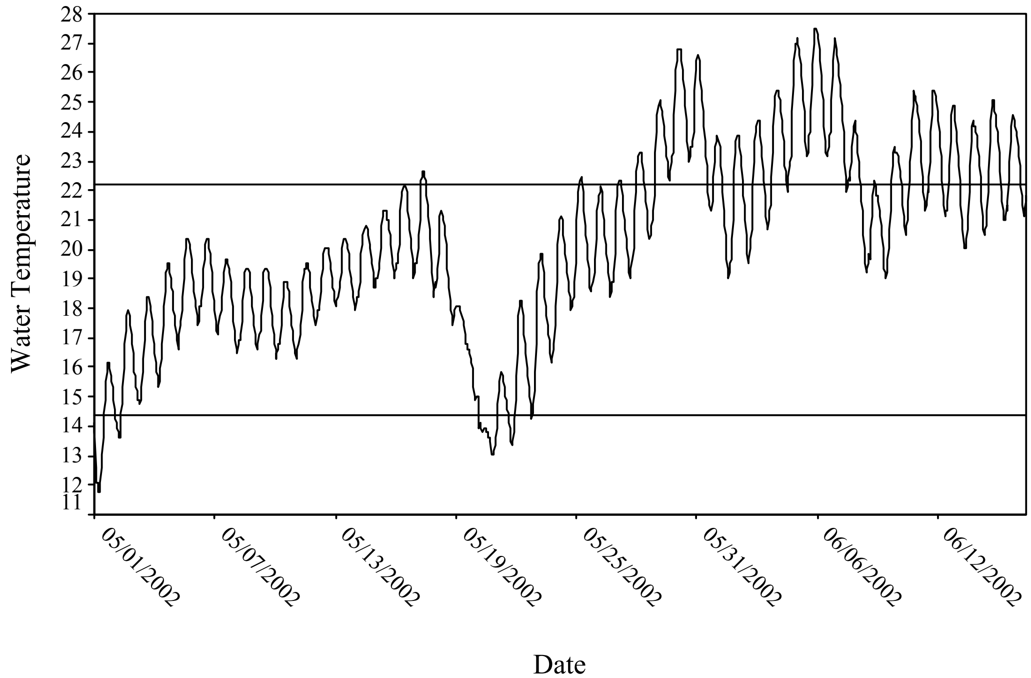


Figure 13. Water temperature time series for Dry Creek at the Riverside Drive station, during the period June 15 through August 31, 2001. Temperatures are not suitable for juvenile rearing.

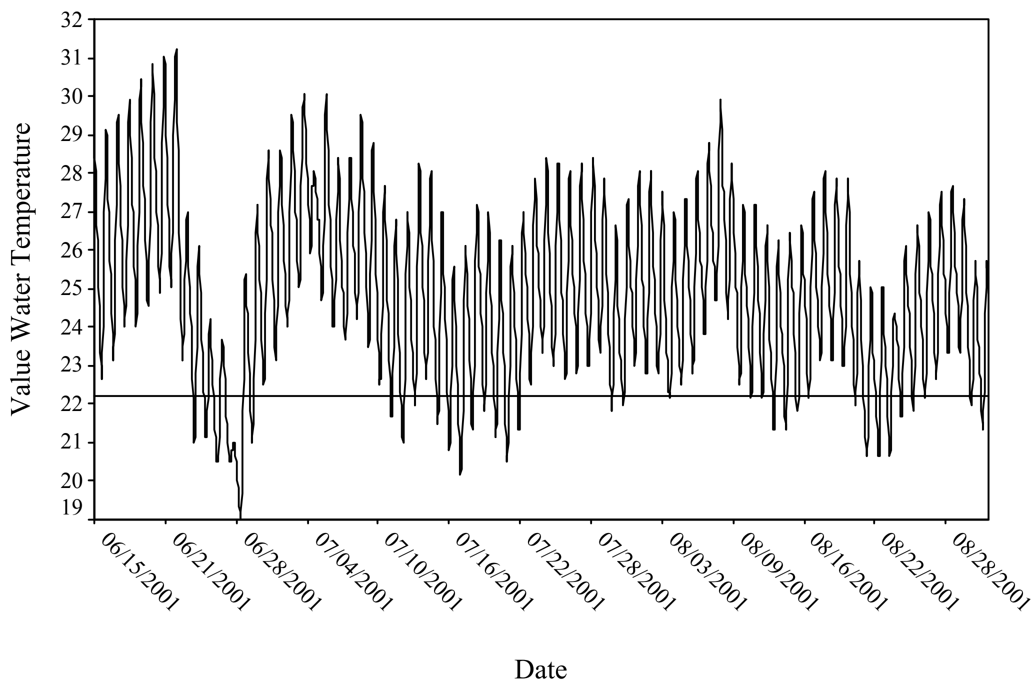


Figure 14. Water temperature time series, Dry Creek at the Riverside Drive station, September 1 through December 31, 2001. Temperatures become suitable for juvenile rearing in mid-September and adult spawning in late-October.

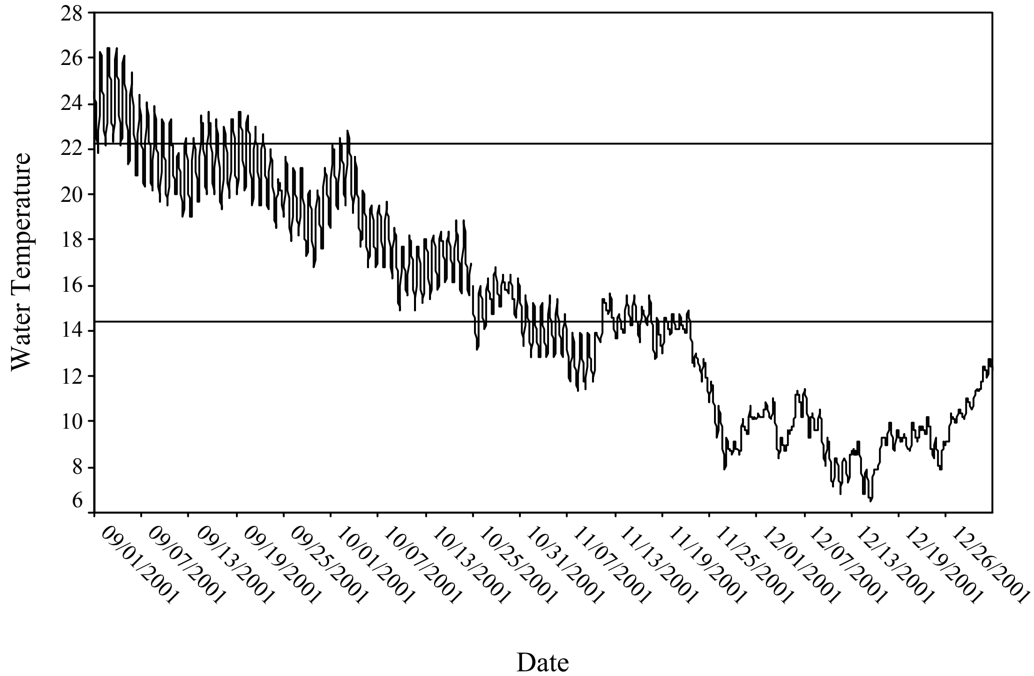


Figure 15. Water temperature time series, Dry Creek at the Riverside Drive station, January 1 through April 30, 2002. Temperatures are suitable for juvenile rearing throughout the entire period. Temperatures are suitable for incubation through about the end of March.

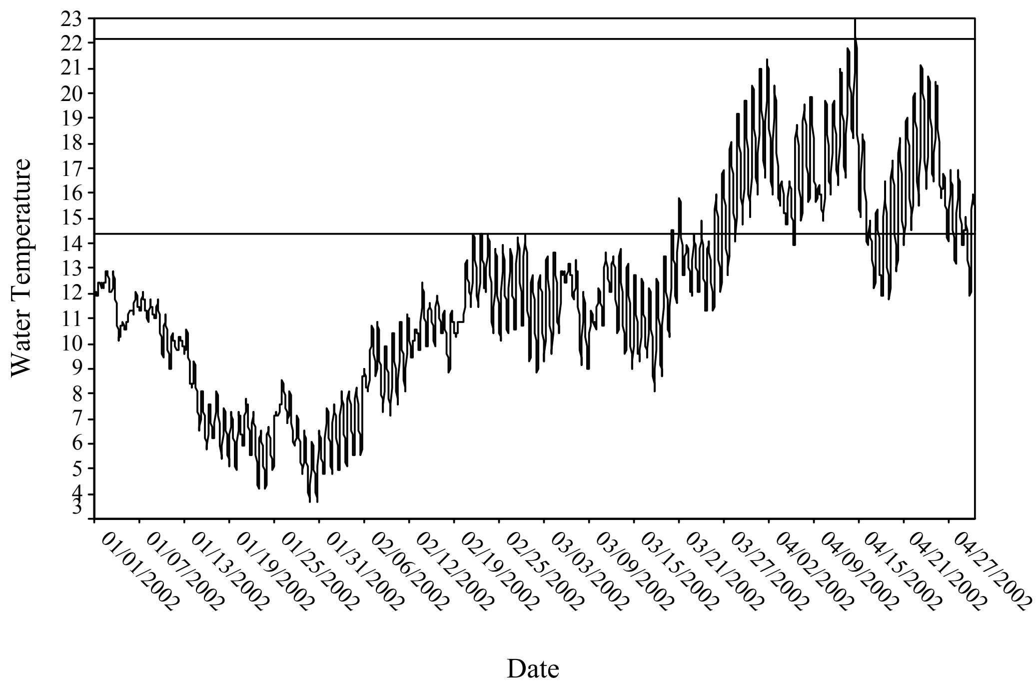
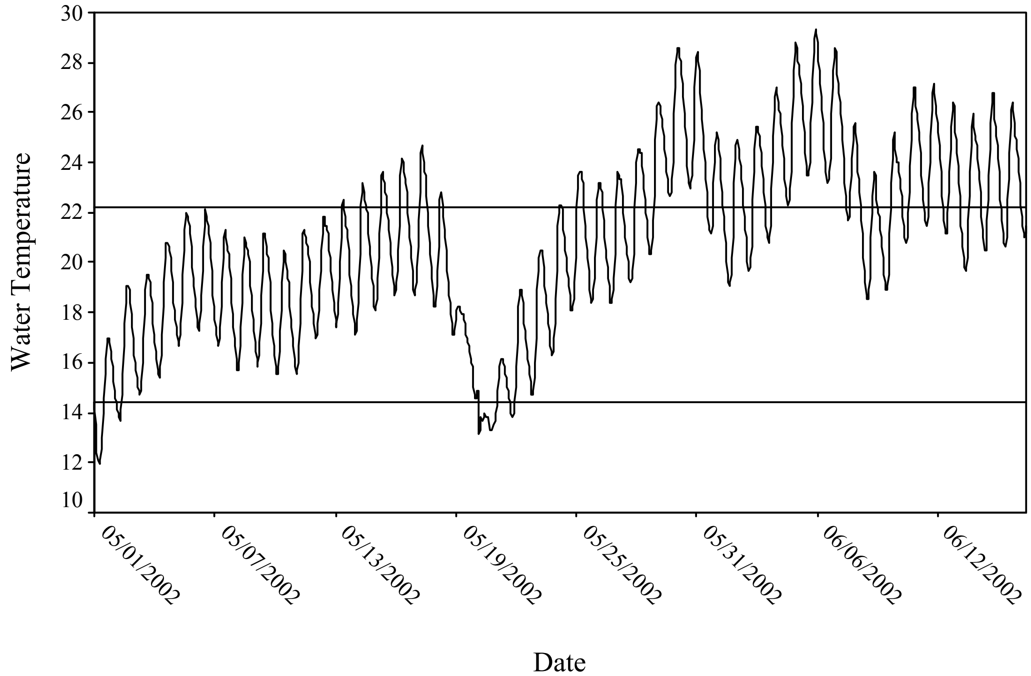


Figure 16. Water temperature time series, Dry Creek at the Riverside Drive station, May 1 through June 17, 2002. Temperatures are suitable for juvenile rearing throughout most of the period.



C. Benthic Invertebrate Data

Members of the Dry Creek Conservancy conduct the sampling program for benthic macroinvertebrates. Sampling data from 2000 at a single and unidentified site in Dry Creek and a sample collected at Royer Park in Roseville in 2001 are presented in Appendix Dry Creek 1. The data indicate a high percentage of pollution tolerant organisms, with almost no taxa that are associated with cleaner waters. These results are not unexpected given the urban nature of the stream and the amount of sediment deposited in the channel. **Source: Dry Creek Conservancy, unpublished data.**

D. Physical Habitat Data

Physical habitat data are limited to three sources for Dry Creek's mainstem:

1. 1992-1993 Habitat Inventory by David Vanicek, Professor at California State University, Sacramento: The habitat inventory was limited to seven reaches *[An eighth reach has been added to Table 5 to cover the stream from the confluence with Antelope Creek to the split into Secret and Miners Ravine for consistency; Vanicek titled this reach Lower Miners Ravine.]*. Vanicek described and rated the habitat conditions (Table 5), and made a series of recommendations regarding improving fish habitat conditions for parts of Dry Creek, Antelope Creek, Secret Ravine, and Miners Ravine. The focus of the recommendations was on riparian vegetation, water flow, instream habitat complexity, increasing the number and size of pool habitats, and addressing impediments to anadromous fish passage (both beaver dams and man-made obstructions).

Vanicek defines flatwater as the same as would be considered a glide in most other methodologies. A 1st class pool is large and deep with more than 30% of the stream bottom obscured, etc., or a maximum depth of > 1.5m. A 3rd class pool is described as small in area or shallow or both. Depth and velocity are sufficient to provide a low velocity holding area for a few adult salmon. Overall habitat quality ratings range from 1 (poor) to 5 (excellent). **Source: Fisheries Habitat Evaluation Dry Creek, Antelope Creek, Secret Ravine, and Miners Ravine (Task I); Prepared for EIP Associates by C. David Vanicek, CSUS Hornet Foundation, August 1993, Copy from CDFG files, Region 2.**

Table 5. Reach, habitat descriptions, and quality assessment for Dry Creek from the Cook Riolo Rd. Bridge upstream to the confluence of Secret and Miners ravines.

Reach and Location	Reach Length (m)	General Conditions (Overall Quality: 1= poor; 5 = excellent)
DC-1a: Cook Riolo Rd. to Sewage Treatment Plant (STP)	1400	Mostly flatwater and shallow pools; a few deep pools (1st class); substrate mostly sand and silt; cover poor to fair; stream volume is increased significantly here by discharge from STP; **Overall quality: 2.**
DC-1b: Lower STP boundary to upper STP boundary	700	Mostly flatwater, with a few 3rd class pools; one 1st class pool at sewage outfall; substrate mostly sand and silt; cover pool; **Overall quality: 1.**
DC-2: City limit west of Atkinson to SPRR tracks	750	Mostly flatwater, but with a few pools (2nd and 3rd class) and riffles; deep holding pool at base of SPRR cascade; substrate mostly sand and silt, but with some rubble areas. Cover poor to fair; **Overall quality: 2**.
DC-3: SPRR to Cirby Creek confluence	1100	Mostly flatwater; very few riffles; a few 2nd and 3rd class pools; mostly sand and silt substrate; cover poor, mostly provided by overhanging vegetation; on 1st class pool at Cirby confluence; disturbed stream bed under SPRR (4 culverts) and Foothill Blvd. overpasses (absence of streamside cover); **Overall quality: 1.**
DC-4: Cirby Creek to Darling Way	300	Nearly all flatwater; a few 3rd class pools; mostly sand and silt substrate; poor cover; dam at Cirby confluence is a barrier at low flows; **Overall quality: 1**.
DC-5: Darling Way to Douglas Blvd.	1150	More habitat diversity here than downstream; flatwater still predominate, but several pools (one 1st class and several 2nd and 3rd class) and riffles; more rubble and gravel substrate than downstream, but sand/silt still most common type; cover fair, provided by pools, log, and overhanging vegetation; two possible low-water barriers: low dam in middle of reach and cascade at Douglas bridge; significant canopy; **Overall quality: 3.**
DC-6: Douglas	900	Some habitat diversity, but much of this reach is

Blvd. to Folsom Rd.		channelized; large pool (2nd class) occupied by domestic waterfowl, presenting an organic pollution problem; a few riffles and pools (2nd and 3rd class); substrate mostly sand and silt, but several areas with rubble and gravel; cover fair; **Overall quality: 2.**
DC-7: Folsom Rd. to Antelope Creek confluence	1520	Fair habitat diversity; flatwater still predominates, but numerous riffles and pools (all 3 classes) present; substrate mostly sand and silt, but rubble and gravel common; fair to good cover provided by pools, in-stream structures and overhanging vegetation; two possible barriers at low flows: debris or rock dam at Lincoln Estates Park and persistent beaver dam just blow Antelope Creek; **Overall quality: 3**.
LMR: Antelope Creek confluence to Secret Ravine confluence	1200	Good habitat diversity (in spite of stream disturbance caused by highway bridges); flatwater still very common, but riffles and pools comprising about 40% of reach; at least on 1st class pool and several 2nd and 3rd class pools; gravel, rubble, and boulder comprise about 50% of substrate; good cover provide by pools, instream structures and overhanging vegetation; possible barriers at low flow: shallow riffle under I-80 bridge, and beaver dams; **Overall quality: 4.**

Source: Fisheries Habitat Evaluation Dry Creek, Antelope Creek, Secret Ravine, and Miners Ravine (Task I); Prepared for EIP Associates by C. David Vanicek, CSUS Hornet Foundation, August 1993, Copy from CDFG files, Region 2.

2. 2002 Foot Survey by Randy Bailey, Bailey Environmental: During November-December of 2002, I conducted foot surveys for spawning chinook salmon from the confluence of Cirby Creek upstream to the confluence with Secret Ravine. I also conducted foot surveys in February 2003 from Harding Blvd. upstream to Secret Ravine. The purpose of the surveys was to supplement surveys being conducted by the Dry Creek Conservancy.

During these surveys, the stream bottom was covered with an excessive load of sediment that appeared to be decomposed granite in origin. The stream was mostly within a confined channel and obviously has been channelized in a number of locations. The soil banks along the stream in this location were more dirt and clay, rather than granite. There was large woody debris in the channel throughout its length. Habitat complexity was good, consisting mostly of pool complexes, but the amount of sediment in the channel limits aquatic insect production in riffle areas. This area is mostly low gradient. Occupation of the area by beavers was observed and may continue to create a problem for anadromous fish passage. This survey generally confirmed Vanicek's findings. **Source: Bailey Environmental, unpublished data.**

3. 2003 Placer County Stream Videography Project: On March 12, 2003 this project shot videotape of Dry Creek from about the Placer County line upstream to the confluence of Secret and Miners ravines. Review of the VHS tape shows that the stream is still very similar to the description by Vanicek. The channel bottom is primarily sand and silt, with riffle areas having a high sediment concentration. The stream appears to suffer from eutrophication problems and aquatic insect production is limited because of the high levels of sediment depositions in the riffle areas. The riparian vegetation appears to be in fair to poor condition. In many locations, the riparian vegetation is very narrow and signs of reproduction are lacking, particularly downstream of about Atkinson Street. The stream has been confined to a relatively narrow corridor and much of the bank protection is riprap. In some protected areas bank erosion is beginning to heal from earlier disturbances, but there are some areas where bank erosion is contributing large amounts of sediment to the channel. Although there are some anecdotal reports of salmon spawning near Folsom Rd. in downtown Roseville, most of this channel should be considered as a migratory corridor. **Source: 2003 Placer County Stream Videography Project, unpublished data.**

E. Fishery Resource Data

1. Documented Fish Species Present in the Stream

This section documents only those fish species captured in a portion of the mainstem of Dry Creek. However, any of the fish species documented in the major tributaries to Dry Creek could contribute other fish species to the list presented below and all of the species should be considered as part of the Dry Creek fish fauna.

Sacramento sucker	Pacific lamprey
Hitch	Spotted bass
Golden shiner	Green sunfish
Bluegill	Smallmouth bass
Black bullhead	Largemouth bass
Carp	Tule perch
Fall-run chinook salmon (native)	
Fall-run chinook salmon (hatchery origin introductions)	
Sacramento pikeminnow (formerly known as Sacramento squawfish)	

Source: California Department of Fish and Game, Region 2 files; Fisheries Habitat Evaluation Dry Creek, Antelope Creek, Secret Ravine, and Miners Ravine (Task I); Prepared for EIP Associates by C. David Vanicek, CSUS Hornet Foundation, August 1993; 1999 Scientific Collecting Permit records from Garcia and Associates (from CDFG files).

2. Fish Stocking Records

Only a single record of fish stocking was found in Department of Fish and Game files for Dry Creek. The record indicates that on 2/17/93, 100,190 fall-run chinook salmon fry from Nimbus Fish Hatchery, weighing 1,165 fish/lb. (36 mm mean length) were stocked at the Southern Pacific Railroad Yard in Roseville. Although this is the only record for Dry Creek, other stockings in Secret and Miners ravines will be documented in the report for those streams separately.

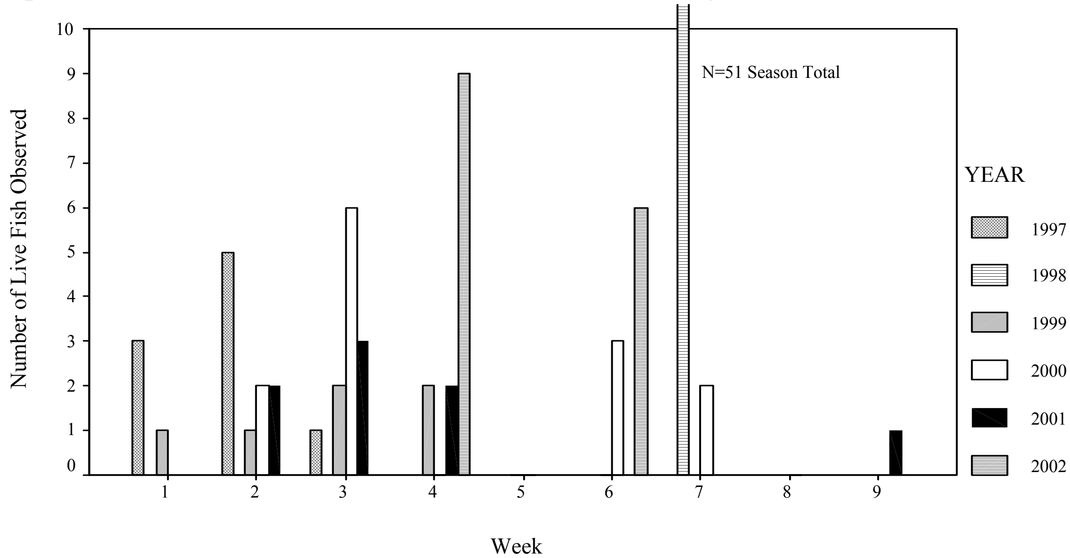
3. Adult Spawning Timing, Distribution, and Population Estimates

- **1992 Spawning Surveys by Dave Vanicek:** Vanicek and his crew conducted foot surveys of selected sections of stream from October 28 to December 29, 1992. During these surveys, the crew concentrated on the deeper pools (holding water) and the entire stretch of reaches DC-3 and DC-4 (see a description of the reaches in the physical habitat section of this report and Table 1 and Figures 2a and 2b in the original Vanicek report). They saw only three live salmon; two in reach DC-4 (plus one carcass) on December 3rd and a third fish in Secret Ravine on January 3, 1993. Four other carcasses were seen in Secret and Miners ravines later in the season. Anecdotal information reported by Vanicek indicated that the salmon run was small in 1992, probably because of rainfall occurring late in the year. **Source: Fisheries Habitat Evaluation Dry Creek, Antelope Creek, Secret Ravine, and Miners Ravine (Task I); Prepared for EIP Associates by C. David Vanicek, CSUS Hornet Foundation, August 1993.**

- **1993 Fall-run Chinook Salmon Spawning Survey by the California Department of Fish and Game:** On 11/24/93, the Department conducted a foot survey from Miners Ravine downstream to Royer Park in Roseville. The survey covered approximately 1 mile of stream north of the Roseville Automall with no fish or redds observed. One female was observed on a redd adjacent to Royer Park. A park employee reported one male salmon. **Source: Unknown author memorandum in CDFG, Region 2 files.**

- **Summary of Dry Creek Conservancy Fall-run Chinook Salmon Surveys in Dry Creek:** Dry Creek Conservancy members have been conducting foot surveys during the fall and early winter since 1997 (Figure 17). The reach surveyed is described as being from Harding Blvd. to a point about 400 yards downstream. Surveys usually begin about November 1 and continue until late December. Surveys are not systematic or comprehensive for the stream, with only a single section surveyed each year and not consistently from week to week throughout the spawning period, although the number of surveys has generally increased in recent years. Dry Creek does have some documented spawning areas that are not surveyed by this effort, but may serve mainly as a migration corridor to upstream spawning areas in Secret and Miners ravines and Antelope Creek. The lack of a comprehensive and systematic survey protocol may not be much of an issue, because the majority of fish passing through Dry Creek may be using the creek as a migration corridor to another spawning area and may pass through this reach in a matter of hours, often in darkness, and therefore may not be detected. However, the magnitude and timing of fish spawning in Dry Creek upstream of the confluence with Cirby Creek cannot be estimated at this time. **Source: Dry Creek Conservancy; unpublished data.**

Figure 17. Summary of fall-run chinook salmon sampling surveys, with number of live fish reported, from 1997 to 2002 in a 1,200 ft. section of Dry Creek in Roseville.



4. Juvenile Distribution and Sampling Data

- **March 1972 One-time Electrofishing Event:** The Department of Fish and Game conducted a one-time electrofishing event on March 30, 1972 at a location described as in the park and zoo area [I conclude this is Royer Park and Zoo area], with no length of stream sampled given. Catch composition is reported as: 1- golden shiner, 1- hitch, and 2-green sunfish. Flow was reported as high. **Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.**

- **August 7, 1992 Electrofishing by Dave Vanicek:** Vanicek and crew electrofished three areas in Dry Creek on August 7, 1992 and recorded the catch shown in Table 6, below. No sampling distance is reported. **Source: Fisheries Habitat Evaluation Dry Creek, Antelope Creek, Secret Ravine, and Miners Ravine (Task I); Prepared for EIP Associates by C. David Vanicek, CSUS Hornet Foundation, August 1993.**

Table 6. Number of fish captured in an August 7, 1992 electrofishing survey at three locations in Dry Creek in Roseville.

Species	Saugstedt Park	Lincoln Estes Park	Eureka Road
Pacific lamprey	--	1	4
Sacramento squawfish [pikeminnow]	1	--	1
Hitch	2	--	--
Sacramento sucker	4	--	--
Bluegill	--	--	2
Green sunfish	--	--	1
Spotted bass	7	9	6

Source: Fisheries Habitat Evaluation Dry Creek, Antelope Creek, Secret Ravine, and Miners Ravine (Task I); Prepared for EIP Associates by C. David Vanicek, CSUS Hornet Foundation, August 1993.

- **1999 Sampling at the Atkinson Street Bridge by Garcia and Associates for the City of Roseville:** The City of Roseville commissioned sampling and water temperature monitoring in connection with the Cirby-Linda-Dry Creek Flood Control Project. Although most monitoring effort was in the Cirby and Linda Creek watersheds, data from the 1999 collection permit for Garcia and Associates contained information for sampling conduced at the Atkinson St. Bridge. Data are summarized on Table 7, but the juvenile anadromous fish captured could have come from Cirby-Linda or Secret-Miners ravines. Information on Table 7 is included only to demonstrate juvenile salmon emigration timing and further document fish species composition in Dry Creek. **Source: 1999 Scientific Collecting Permit records from Garcia and Associates (CDFG files).**

Table 7. Summary of fish sampling conducted on four dates in 1999 at the Atkinson Street Bridge in Roseville.

Species	4/27/99	5/6/99	5/21/99	5/28/99
Chinook salmon	20	21	5	--
Sacramento pikeminnow	7	5	3	7
Sacramento sucker	5	11	10	7
Bluegill	2	--	1	1
Green sunfish	5	4	3	2
Smallmouth bass	4	1	4	3
Spotted bass	6	8	2	4
Hitch	--	15	--	--
Pacific lamprey	--	--	--	1

Source: 1999 Scientific Collecting Permit records from Garcia and Associates (CDFG files).

- **May 2002 Electrofishing Effort by John Nelson, CDFG, Region 2:** Nelson conducted several sampling efforts in April and May of 2002, based on a citizen inquiry about northern pike presence in Dry Creek. Department staff visually surveyed a 400 m reach near the Cook Riolo Rd. Bridge on April 22. On May 3, electrofishing was conducted at the Cook Riolo Rd. Bridge and at a location approximately 400 m upstream. Sections sampled were approximately 150 m. On May 29th, an additional 150 m section was sampled near the Atkinson Street Bridge in Roseville. Combined sampling results are presented in Table 8. **Source: July 10, 2002 Memorandum from John Nelson, Department of Fish and Game; Region 2 files.**

Table 8. Combined electrofishing results from sampling conducted near the Cook Riolo Rd. Bridge and Atkinson Street Bridge in May of 2002.

Species	5/3/2002	5/29/2002
Sacramento pikeminnow	10	--
Largemouth bass	4	5
Sacramento sucker	5	4
Smallmouth bass	2	2
Green sunfish	1	1
Chinook salmon	1	0

Source: July 10, 2002 Memorandum from John Nelson, Department of Fish and Game; Region 2 files.

F. Fish Passage or Screening Data

Vanicek's report discusses man-made structures and natural barriers in the context of what was known about salmon and steelhead distribution in 1993. For example, Vanicek does not recommend any beaver dam removal upstream of the fourth bike path crossing on Miners Ravine because he believed that steelhead would not be present in the Dry Creek Watershed. Subsequent sampling by the Department of Fish and Game (Rob Titus) has demonstrated that steelhead do occur in the watershed. Vanicek's main concern was the large number of beaver dams present in the system, certain riffles and low rock dams that might be barriers at low flows, and the pipeline crossing at the confluence with Cirby Creek near Riverside Drive. Anadromous fish routinely migrate into the watershed to spawn. However, the key to ensuring population stability is to allow full access on an annual basis. Access to spawning areas should not be subject to the limitations of low flows and/or partial or complete barriers, whether man-made or natural. Vanicek expresses concerns about the fish ladder at the Southern Pacific Railroad Yard and the number of apparently persistent beaver dams in the watershed. However, Vanicek's inventory is over 10 years old, and there may have been significant changes in the overall situation since then. The pipeline crossing at the Cirby Creek confluence is still a problem, but conditions may have changed over the decade. A new survey of all potential barrier problems should be completed before any conclusions are drawn. The recent Department of Water Resources habitat and barrier inventory on Miners Ravine could be used as a partial template for a new evaluation.

APPENDIX DRY CREEK 1

BENTHIC MACROINVERTEBRATE DATA
COLLECTED BY THE DRY CREEK CONSERVANCY

Dry Creek Benthic Macroinvertebrate Samples 2000 - 2001

	TV	FFG	Dry Creek 2000				Dry Creek @ Royer Park 2001			
SAMPLING STATION:			2000				2001			
REPLICATE #	TV	FFG	54	55	56	Total	64	65	66	Total
PHYLUM ARTHROPODA										
Class Insecta										
Coleoptera (Larvae)										
Elmidae	4	c								
Dubiraphia sp.	6	c								
Microcylloepus sp.	4	c								
Diptera										
Ceratopogonidae	6	p								
Bezzia sp./ Palpomyia sp.	6	p								
Dasyhelea sp. (pupa)	6	nf								
Chironomidae	6									
Chironominae										
Chironomini	6	c								
Pseudochironomini	5	c							1	1
Tanytarsini	6	c	31	25	29	85	74	34	63	171
Orthocladiinae	5	c	63	42	31	136	29	17	33	79
Tanypodinae	7	p							1	1
Empididae	6	p								
Clinocera sp.	6	p								
Hemerodromia sp.	6	p								
Neoplasta sp.	6	p								
Muscidae	6	p								
Limnophora sp.	6	p								
Simuliidae	6	f								
Simulium sp.	6	f	13	10	28	51	5	10	4	19
Tipulidae	3									
Limonia sp.	6	s								
Hemiptera										
Corixidae	8	p								
Sigara sp.	8	p								
Megaloptera										
Sialidae	4	p								
Sialis sp.	4	p								
Odonata										
Calopterygidae	5	p								

	_		*Hetaerina sp.*	6	p								
	_	Coenagrionidae			p								
	_		*Argia sp.*	7	p							1	1
	_	Gomphidae		4	p								
	_		*Ophiogomphus occidentis.*	4	p								
	_	Libellulidae		9	p								
	_		*Brechmorhoga mendax*	9	p	2		4	6		1	3	4
	_												
Lepidoptera													
	_	Nepticulidae			s								
	_	Pyralidae		5									
	_		*Petrophila sp.*	5	g	2	1	1	4	5		2	7
	_												
Ephemeroptera													
	_	Baetidae		4	g								
	_		*Baetis sp.*	5	c	20	17	16	53	7	3	6	16
	_		*Camelobaetidius sp.*	4	c					2			2
	_		*Fallceon quilleri*	4	c					4	1	1	6
	_	Caenidae		7	c								
	_		*Caenis sp.*	7	c								
	_	Ephemerellidae		1	c								
	_		*Eurylophella lodi*	1	c								
	_	Leptohyphidae		4	c								
	_		*Tricorythodes minutus*	4	c						1	1	2
	_												
Plecoptera													
	_	Chloroperlidae		1	p								
	_	Perlodidae		2	p								
	_		*Isoperla sp.*	2	p								
	_												
Trichoptera													
	_	Glossosomatidae		0	g								
	_		*Protoptila coloma*	1	g								
	_	Helicopsychidae		3	g								
	_		*Helicopsyche borealis*	3	g								
	_	Hydropsychidae		4	f								
	_		*Hydropsyche californica*	4	f	66	20	35	121	35	7	36	78
	_	Hydroptilidae		4	g								
	_		*Hydroptila sp.*	6	g	2	1		3	1			1
	_		*Leucotrichia pictipes*	6	g			1	1	1	1	1	3
	_		*Ochrotrichia sp.*	4	c								
	_		*Oxyethira sp.*	3	c					1			1
	_	Lepidostomatidae		1	s								
	_		*Lepidostoma sp.*	1	s								
	_	Leptoceridae		4	c								
	_		*Mystacides alafimbriata*	4	c								

Nectopsyche gracilis	3	c								
Triaenodes/Ylodes sp.	6	s								
Philopotamidae	3	f								
Chimarra sp.	4	f								
Wormaldia sp.	3	f								
Subphylum Chelicerata										
Class Arachnoidea										
Acari										
Hygrobatidae	8	p								
Hygrobates sp.	8	p					4		3	7
Megapella sp.	8	p								
Lebertiidae	8	p								
Lebertia sp.	8	p	2	5	4	11		2		2
Sperchontidae	8	p								
Sperchon sp.	8	p	6	9	9	24	1	2	6	9
Torrenticolidae	5	p								
Torrenticola sp.	5	p								
Subphylum Crustacea										
Class Malacostraca										
Amphipoda										
Cragonyctidae	4	c								
Crangonyx sp.	4	c			2	2				
Stygobromus sp.	4	c								
Hyalellidae	8	c								
Hyalella sp.	8	c								
Decapoda										
Astacidae	8	c								
Pacifasticus lenisculus	6	c							1	1
Class Ostracoda										
Ostracoda	8	c								
Cyprididae	8	c								
PHYLUM COELENTERATA										
Class Hydrozoa										
Hydroida										
Hyridae										
Hydra sp.	5	p								
PHYLUM MOLLUSCA										
Class Gastropoda										
Pulmonata										
Ancylidae	6	g								
Ferrissia sp.	6	g	1		2	3				
Lymnaeidae	6	g								

Fossaria sp.	8	g								
Physidae	8	g								
Physa sp./ Physella sp.	8	g								
Planorbidae	6	g								
Gyraulus sp.	8	g								
Helisoma sp.	6	g								
Micromenetus sp.	6	g	1	4	2	7	1	1		2
Class Bivalvia										
<u>Pelecypoda</u>	8	f								
Corbiculidae	10	f								
Corbicula fluminea	10	f	9	14	1	24	17	3	10	30
Sphaeriidae	8	f								
Pisidium sp.	8	f							1	1
PHYLUM NEMATODA	5	p	4	7	5	16	10	1	5	16
PHYLUM PLATYHELMINTHES										
Class Turbellaria										
<u>Tricladida</u>										
Planariidae	4	p								
Dugesia tigrina	4	p	43	75	45	163	7	59	10	76
PHYLUM ANNELIDA										
Class Oligochaeta	5	c	37	86	51	174	65	137	119	321
<u>Megadrili</u>	5	c								
PHYLUM NEMERTEA										
Class Enopla										
Tertastemmatidae										
Prostoma graecense	8	p	8	26	20	54	20	8	10	38
Total			310	342	286	938	289	288	318	895
Taxa Richness			17	15	18	19	19	17	22	27
Percent Dominant Taxon			21	25	18	19	26	48	37	36
EPT Taxa			3	3	3	4	7	5	5	8
EPT Index (%)			28.4	11.1	18.2	19.0	17.6	4.5	14.2	12.2
Sensitive EPT Index			0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.1
Ephemeroptera Taxa			1.0	1.0	1.0	1.0	3.0	3.0	3.0	4.0
Plecoptera Taxa			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trichoptera Taxa			2.0	2.0	2.0	3.0	4.0	2.0	2.0	4.0
Dipteran Taxa			3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0
Percent Dipteran			34.5	22.5	30.8	29.0	37.4	21.2	32.1	30.3
Non-Insect Taxa			9.0	8.0	10.0	10.0	8.0	8.0	9.0	11.0
Percent Non-Insect			35.8	66.1	49.3	51.0	43.3	74.0	51.9	56.2
Percent Chironomidae			30.3	19.6	21.0	23.6	35.6	17.7	30.8	28.2
Percent Hydropsychidae			21.3	5.8	12.2	12.9	12.1	2.4	11.3	8.7
Percent Baetidae			6.5	5.0	5.6	5.7	4.5	1.4	2.2	2.7

Shannon Diversity	2.2	2.2	2.4	2.3	2.2	1.7	2.0	2.1
Tolerance Value	5.1	5.4	5.3	5.3	5.7	5.1	5.5	5.4
Percent Intolerant (0-2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percent Tolerant (8-10)	8.7	15.8	13.3	12.7	14.5	5.6	10.4	10.2
Percent Collectors	48.7	49.7	45.1	48.0	63.0	67.0	70.8	67.0
Percent Filterers	28.4	12.9	22.4	20.9	19.7	6.9	16.0	14.3
Percent Grazers	1.9	1.8	2.1	1.9	2.8	0.7	0.9	1.5
Percent Predators	21.0	35.7	30.4	29.2	14.5	25.3	12.3	17.2
Percent Shredders	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Percentages	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Total Abundance	1063	342	572		495	2304	2544	

Dry Creek Benthic Macroinvertebrate CSBP Summary Metrics, 2000 - 2001

	Dry Creek			Dry Creek @ Royer Park		
	2000			2001		
	Mean	CV	Total	Mean	CV	Total
Taxa Richness	16.7	9.2	19.0	19.3	13.0	27.0
Percent Dominant Taxon	21.4	17.1	18.6	36.9	29.8	35.9
EPT Taxa	3.0	0.0	4.0	5.7	20.4	8.0
EPT Index (%)	19.2	45.2	19.0	12.1	56.2	12.2
Sensitive EPT Index	0.0	#DIV/0!	0.0	0.1	173.2	0.1
Ephemeroptera Taxa	1.0	0.0	1.0	3.0	0.0	4.0
Plecoptera Taxa	0.0	#DIV/0!	0.0	0.0	#DIV/0!	0.0
Trichoptera Taxa	2.0	0.0	3.0	2.7	43.3	4.0
Dipteran Taxa	3.0	0.0	3.0	3.7	31.5	5.0
Percent Dipteran	29.3	21.0	29.0	30.2	27.3	30.3
Non-Insect Taxa	9.0	11.1	10.0	8.3	6.9	11.0
Percent Non-Insect	50.4	30.1	51.0	56.4	28.1	56.2
Percent Chironomidae	23.6	24.7	23.6	28.1	33.1	28.2
Percent Hydropsychidae	13.1	59.1	12.9	8.6	62.4	8.7
Percent Baetidae	5.7	13.1	5.7	2.7	59.8	2.7
Shannon Diversity	2.3	4.1	2.3	2.0	13.5	2.1
Tolerance Value	5.3	2.7	5.3	5.4	5.1	5.4
Percent Intolerant (0-2)	0.0	#DIV/0!	0.0	0.0	#DIV/0!	0.0
Percent Tolerant (8-10)	12.6	28.5	12.7	10.2	44.2	10.2
Percent Collectors	47.8	5.1	48.0	66.9	5.8	67.0
Percent Filterers	21.2	36.9	20.9	14.2	46.2	14.3
Percent Grazers	1.9	8.9	1.9	1.5	77.1	1.5
Percent Predators	29.0	25.7	29.2	17.4	40.2	17.2
Percent Shredders	0.0	#DIV/0!	0.0	0.0	#DIV/0!	0.0

MINERS RAVINE

A. Water Quality Data

1. 2001 Central Valley Regional Water Quality Control Board. The Central Valley Regional Water Quality Control Board (Regional Board) has collected water quality data for several sites in the Miners Ravine Watershed (defined in this report as upstream of the confluence with Secret Ravine) since October of 2000. During October 2000 through February 2002, the Regional Board staff conducted approximately monthly monitoring at the Auburn Folsom Road crossing. The Regional Board collections also included pesticide scans with no problems noted. Metals data indicate that the concentration of copper (0.008 mg/l) in a sample collected at Dick Cook Road in November 2001 exceeded the standards (Table 1) at a water hardness of 50 mg/l. While no hardness measurements were taken at the time of sampling, contemporary measurements indicate that hardness must have been near 50 mg/l. Data on hardness in the stream over the course of the one-year of monthly monitoring ranged from 28-84 mg/l, which demonstrate that the water quality standards at a hardness of 50 mg/l are applicable. Measurements of copper at the confluence with Secret Ravine in November of 2001 and 2002 were below detection limits. **Source: Central Valley Regional Water Quality Control Board, unpublished data.**

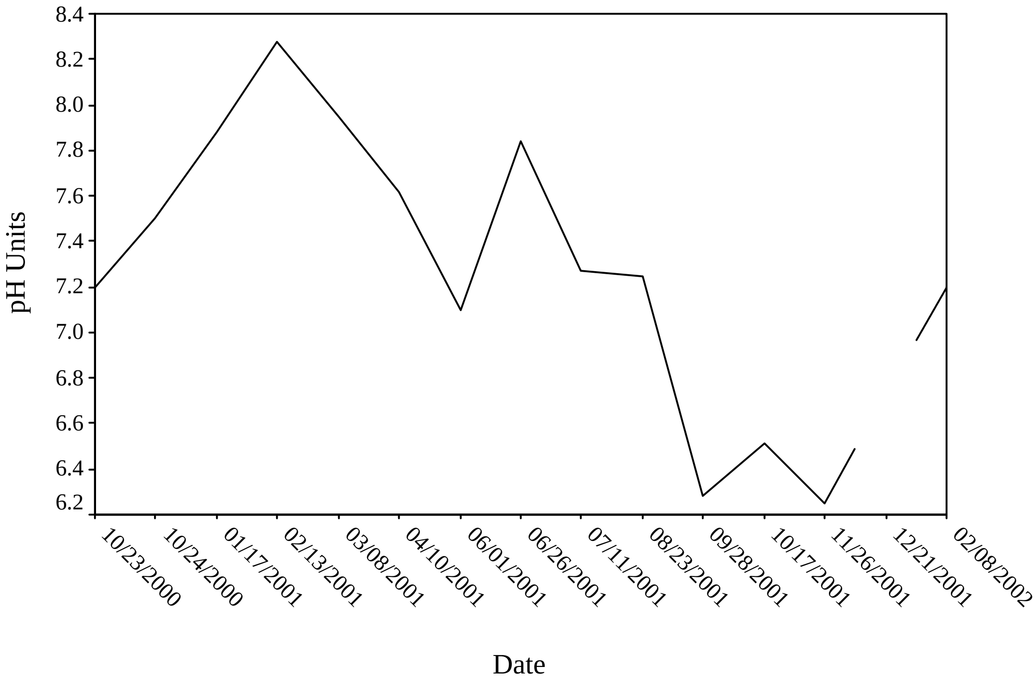
Table 1. California Toxics Rule water quality standards for selected metals, based on a hardness of 50 mg/l as CaCO3.

Metal	Maximum Concentration (Acute) (mg/l)	Continuous Concentration (Chronic) (mg/l)
Barium	No standard	No standard
Cadmium	0.002	0.0013
Copper	0.007	0.005
Zinc	0.067	0.066

Source: California Toxics Rule (water quality objectives)

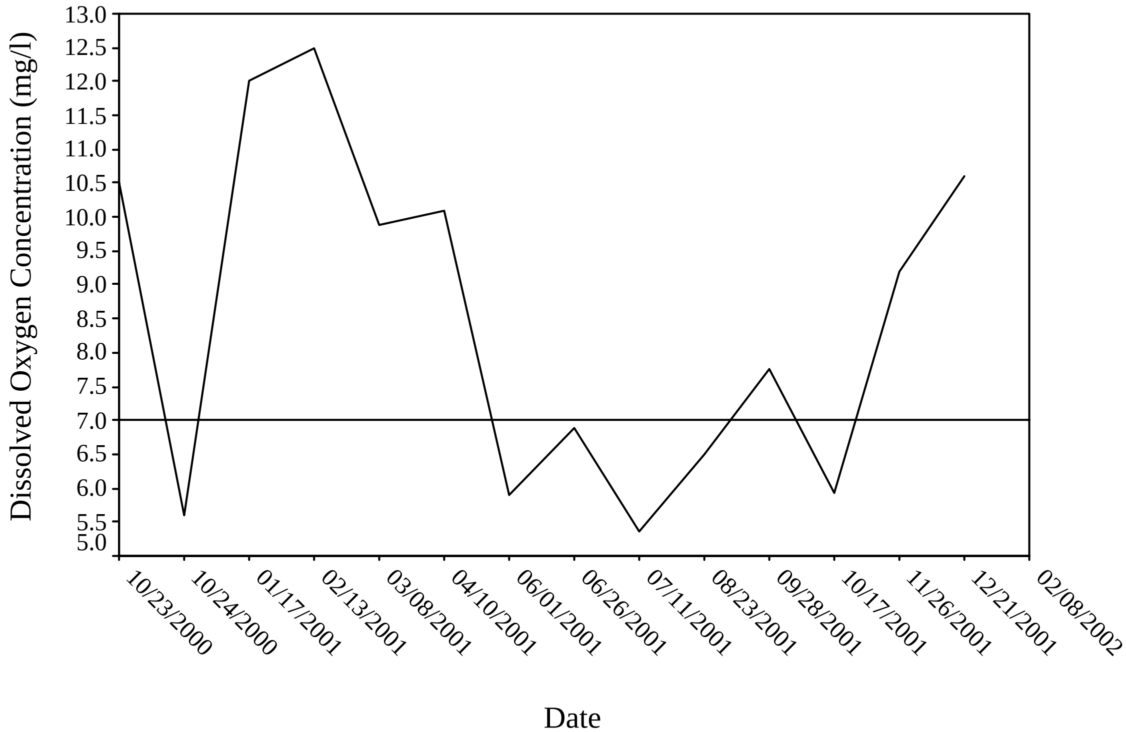
Three other water quality parameters are also of concern. The first is the fluctuations in pH values over the course of a year. This is the same pattern noted in adjacent streams and watersheds. Figure 1 displays the pH data from the Regional Board data taken at Auburn Folsom Road.

Figure 1. Monthly time series of pH data taken in Miners Ravine at Auburn Folsom Road during the period October 2000 to February 2002.



The second parameter of concern is the annual fluctuation in dissolved oxygen concentration recorded at this same site (Regional Board; Figure 2). The concern is that summer and early fall concentrations drop below the recommended level of 7.0 mg/l for anadromous fish. While the minimum concentration recorded is 5.35 mg/l, which is still above the absolute minimum recommended for coldwater fisheries, this is a one-time grab sample. Most of these summer dissolved oxygen samples were collected in the afternoon (1300-1600 hrs), which is the period of time when dissolved oxygen concentrations would be near or at their daily maximums. No data is recorded for the time period 0300-0400 hours when dissolved oxygen concentrations would generally be at their daily minimums. Additional seasonal and diel sampling should be conducted at multiple locations to determine the extent of the problem, if any.

Figure 2. Monthly time series of dissolved oxygen concentration taken in Miners Ravine at Auburn Folsom Road during the period October 2000 to February 2002.
Note the reference line at 7.0 mg/l, which is the recommended minimum concentration for coldwater fisheries.



2. Dry Creek Conservancy Monitoring Data. The Dry Creek Conservancy (DCC) has conducted periodic "first flush" and/or quarterly monitoring upstream of Cottonwood Dam, at Dick Cook Road, and at the confluence with Secret Ravine. A variety of parameters are collected, but the data are not comprehensive or systematic for all parameters. Data from the Dry Creek Conservancy are thus inappropriate for use in trend analysis or to identify general problems. However, although only one sample of nitrate and orthophosphate has been collected in the watershed (November 2002 at the confluence with Secret Ravine), the ratio between the two constituents was near 1:1. While the overall concentrations (0.67 and 0.72 mg/l for nitrate and orthophosphate, respectively) were not critically high, there is cause for concern. First, this sample was collected in November when nutrient input to the stream is usually near its low point for the year. Second, no sampling has occurred during the summer time period in this watershed, and thus summer nutrient levels are unknown.

The DCC data are also probably consistent with summer concentration data from recorded in downstream Dry Creek, where nitrate levels have exceeded 4.0 mg/l. Also, the DCC data indicate that the desirable ratio of nitrate to phosphate of 10:1, with nitrate concentrations no greater than 1.0 mg/l, may not be present in this stream during some portion of the year. It appears that phosphorus is not a limiting nutrient at this time and that additional inputs of nitrates from sources such as runoff and lawn fertilizers could create biostimulation and declines in

dissolved oxygen during the summer and early fall time period. The Regional Board's dissolved oxygen data presented in Figure 2 also may be an indication that that is occurring.
In analyzing the Regional Board and DCC data, it should be noted that the data on dissolved oxygen and nitrate/orthophosphate are from different stations miles apart and there is no summer data for nitrates/orthophosphates or diel dissolved oxygen data to support any hypothesis. Additional sampling to clarify the situation should be a high priority. A complete set of all water quality data is available electronically from the DCC, while Bailey Environmental has a complete copy of the provisional data. **Source: Dry Creek Conservancy, unpublished data.**

B. Water Temperature Data

Detailed long-term water temperature data is limited to hourly monitoring funded by Placer County and conducted by Bailey Environmental (initiated May 2003) and 1999-2003 data from recent sampling by California Department of Fish and Game (Rob Titus) from a monitoring site near Dick Cook Road. Titus has additional data from previous years but it is not currently available. All data retrieved to date is plotted in the figures below. Since daily maximum, minimum, and/or mean temperatures individually are of little value, I have chosen to plot all data points. Therefore, I have split the year into time periods that roughly correspond to:

Fall-early winter: September though December: primary fall-run chinook salmon spawning period is November-December.
Winter-spring: January though April: fall-run chinook salmon incubation and rearing and steelhead spawning, incubation, and rearing.
Late spring-summer: May to September: summer rearing for steelhead juveniles.

Data plots for these time periods are presented below to permit assessment of the potential of Miners Ravine to support chinook salmon and/or steelhead trout spawning and rearing. A variety of localized data and literature on water temperature and salmonids was reviewed to establish general parameters of temperature effects on various life history stages for both chinook salmon and steelhead trout. There is fairly substantial variation in temperature effects noted for most life history stages. However, both chinook salmon and steelhead have a highly adaptable physiology and ability to seek thermal refuge during part of the day which may allow them to tolerate and/or avoid lethal temperatures. Some of the literature sources cite criteria from others and some of the data is based on fish captures with water temperature taken concurrently. Two tables with data and reference are included in Appendix A of this report. Based on this review, the following criteria have been used to indicate what life history stages a particular stream may support at any given time:

Chinook Salmon	**^{O}C**	**Steelhead Trout**	**^{O}C**
Egg and fry development	14.4 (58 ^{O}F)	Egg and fry development	14.4 (58 ^{O}F)
Juvenile rearing	21.1 (70 ^{O}F)	Juvenile rearing	22.2 (72 ^{O}F)
Adult migration	21.7 (71 ^{O}F)	Adult migration and holding	22.2 (72 ^{O}F)

Accordingly, reference lines for 14.4 ^{O}C and 22.2 ^{O}C have been provided on Figures 3-10 to roughly represent the water temperatures suitable for salmonid spawning migration, egg and fry development, and juvenile rearing.

1. 1998-2003 Sampling in Miners Ravine by Rob Titus, California Department of Fish and Game: Titus' memorandum presents information on daily maximum and average water temperatures at more than one location in Miners Ravine over the period June 1, 1999 though August 31, 1999. He indicates that water temperatures spiked at 77 ^{O}F on three occasions in July 1999 and averaged 70 ^{O}F over the three-month period. No detailed data are presented, but Titus must have much more data available. In addition Titus provided detailed data (Figures 3-6) from a monitoring site near Dick Cook Road for the period July 30, 2002 through August 27, 2003. Titus has additional data for previous years. These data will be made available by mid-December 2003. The data will be provided to Placer County when it becomes available. **Source: Memorandum, dated November 5, 2001, and unpublished data from CDFG Biologist Rob Titus, CDFG, Region 2 files.**

Figure 3. Water temperature time series for Miners Ravine at the Dick Cook Road crossing, for the period May 30 through August 31, 2002. Temperatures are suitable for juvenile rearing.

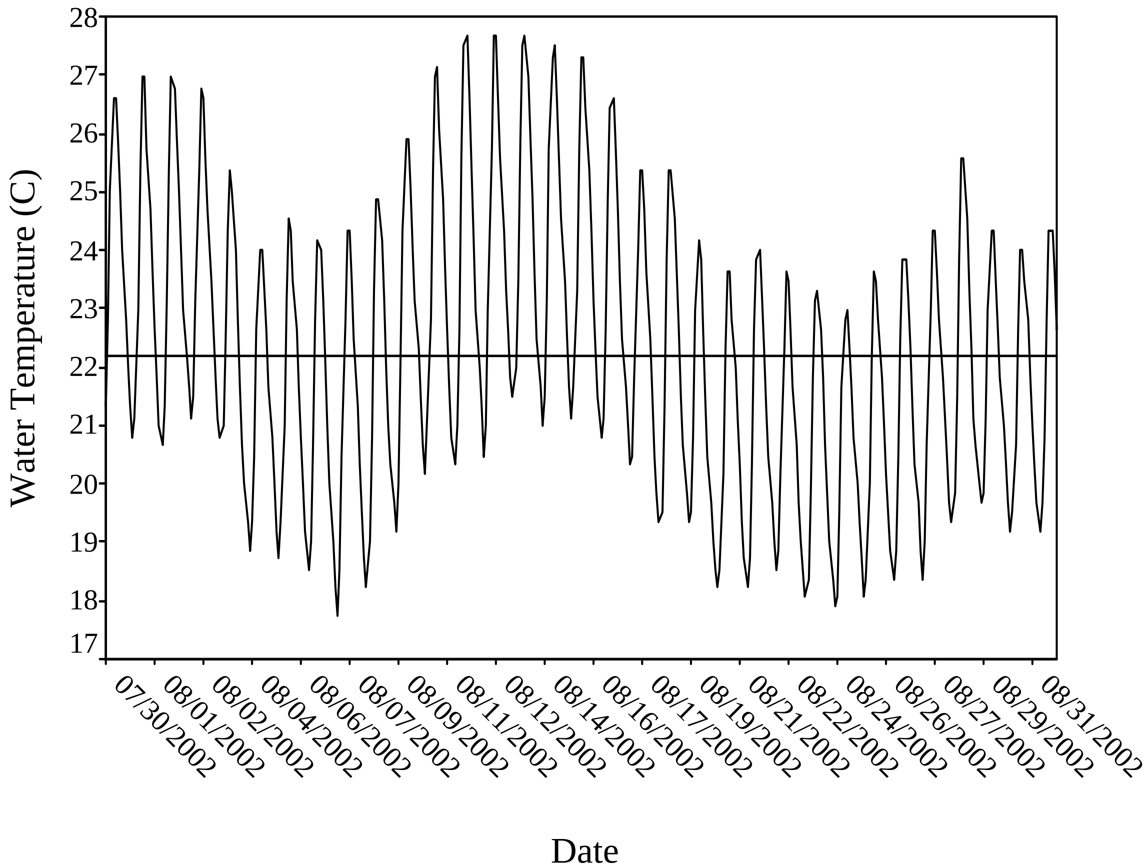


Figure 4. Water temperature time series for Miners Ravine at the Dick Cook Road crossing, for the period September 1 through December 31, 2002. Temperatures are suitable for juvenile rearing and adult spawning.

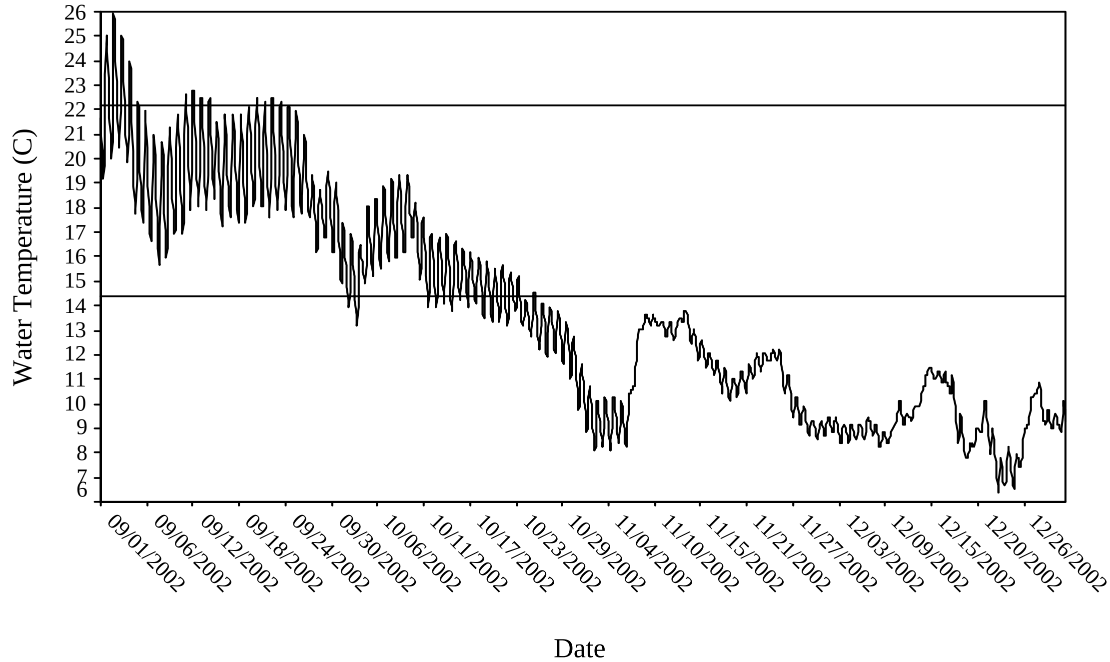


Figure 5. Water temperature time series for Miners Ravine at the Dick Cook Road crossing, for the period January 1 through April 30, 2003. Temperatures are suitable for juvenile rearing and adult spawning.

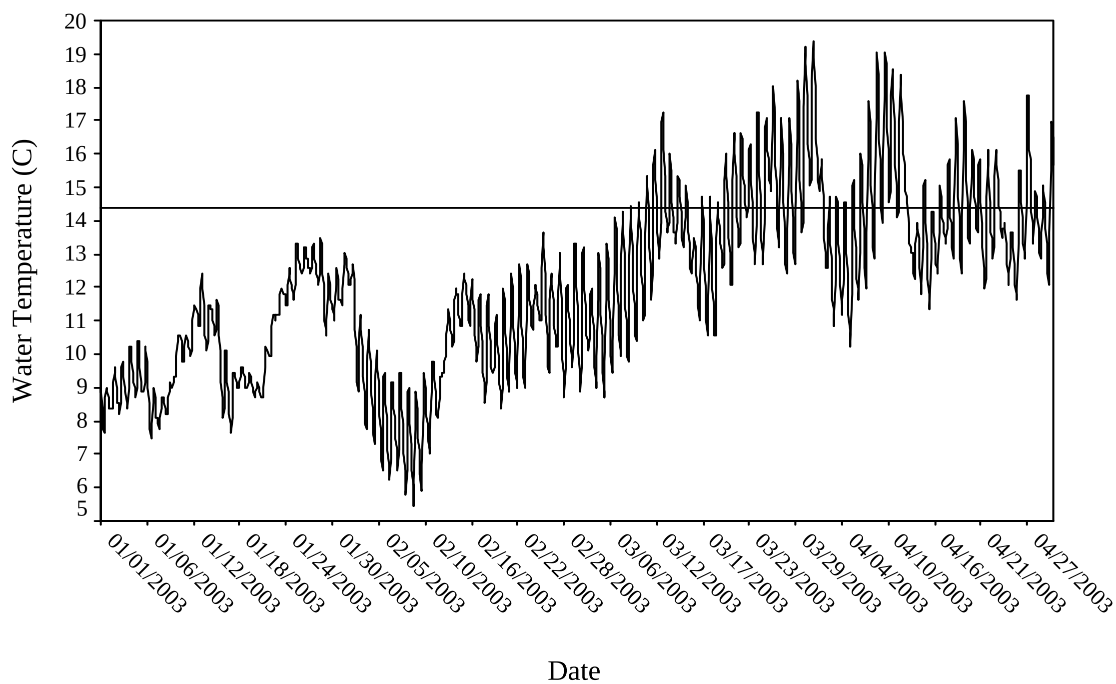
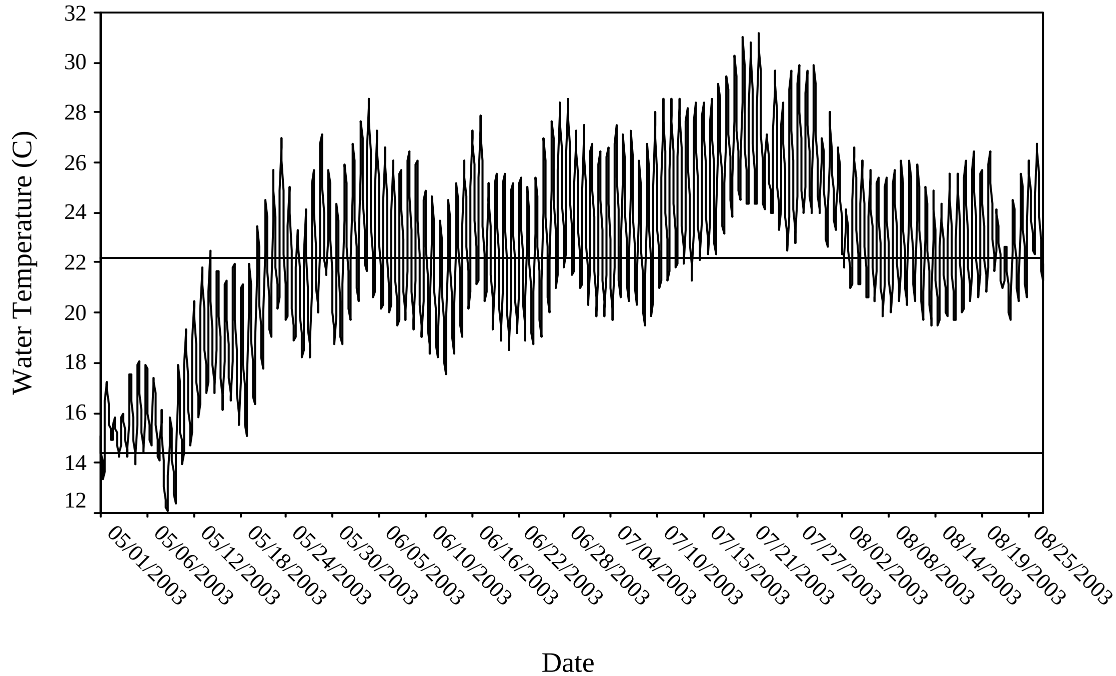


Figure 6. Water temperature time series for Miners Ravine at the Dick Cook Road crossing, for the period May 1 through August 27, 2003. Temperatures are suitable to marginal for juvenile rearing.



2. Water Temperature Information from Bailey Environmental May to August 2003: In May 2003, Placer County contracted to add additional stations on Miners Ravine. Stations were added at the Miner Ravine Road Crossing, Barton Road Crossing, Cavitt-Stallman Road Crossing, and at the Olympus Point development in Roseville behind the United Artists theatre complex. Figures 7-10 display all of the data to date (which has also been delivered to the County in electronic format). **Source: Bailey Environmental, unpublished data.**

Figure 7. Water temperature time series for Miners Ravine at the Miner Ravine Road crossing, for the period May 31 through August 5, 2003. Temperatures are marginal for juvenile rearing.

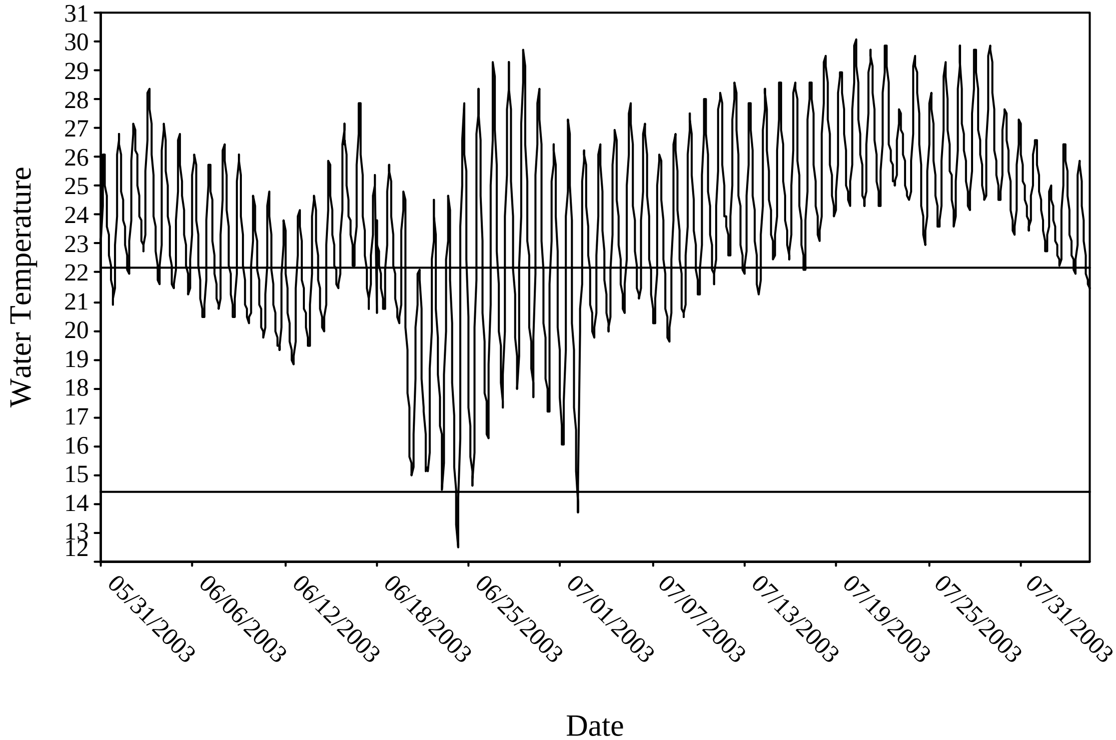


Figure 8. Water temperature time series for Miners Ravine at the Barton Road crossing, during the period June 5 through August 5, 2003. Temperatures are marginal to unsuitable for juvenile rearing, depending on the availability of thermal refugia.

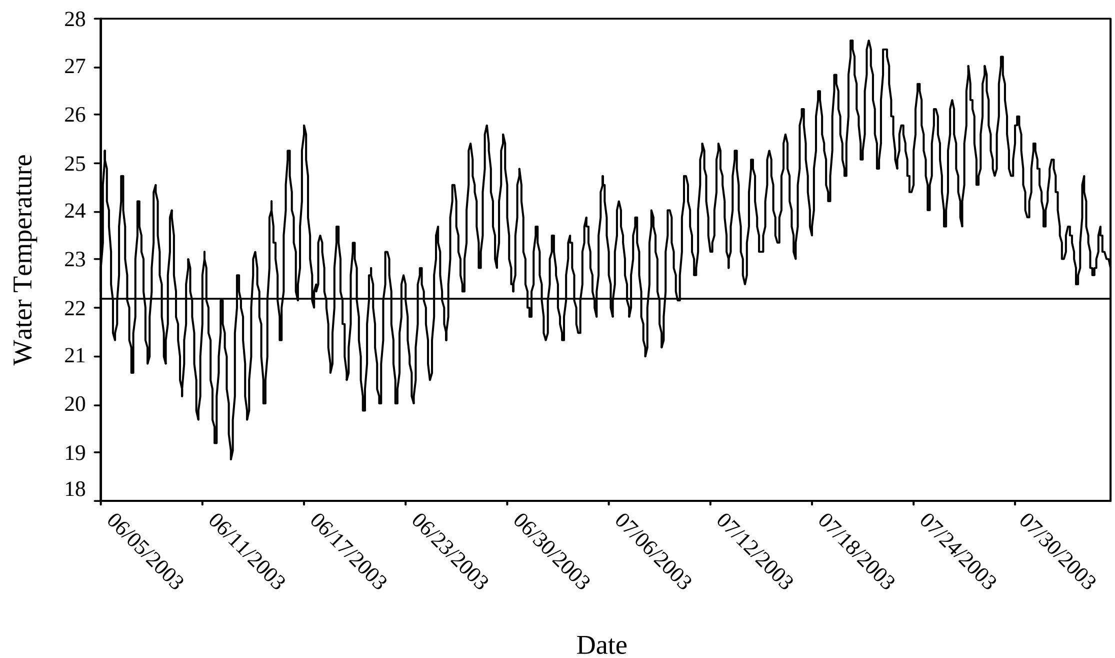


Figure 9. Water temperature time series for Miners Ravine at the Cavitt-Stallman Road crossing, May 31 through August 5, 2003. Temperatures are marginally suitable for juvenile rearing, depending on the availability of thermal refugia.

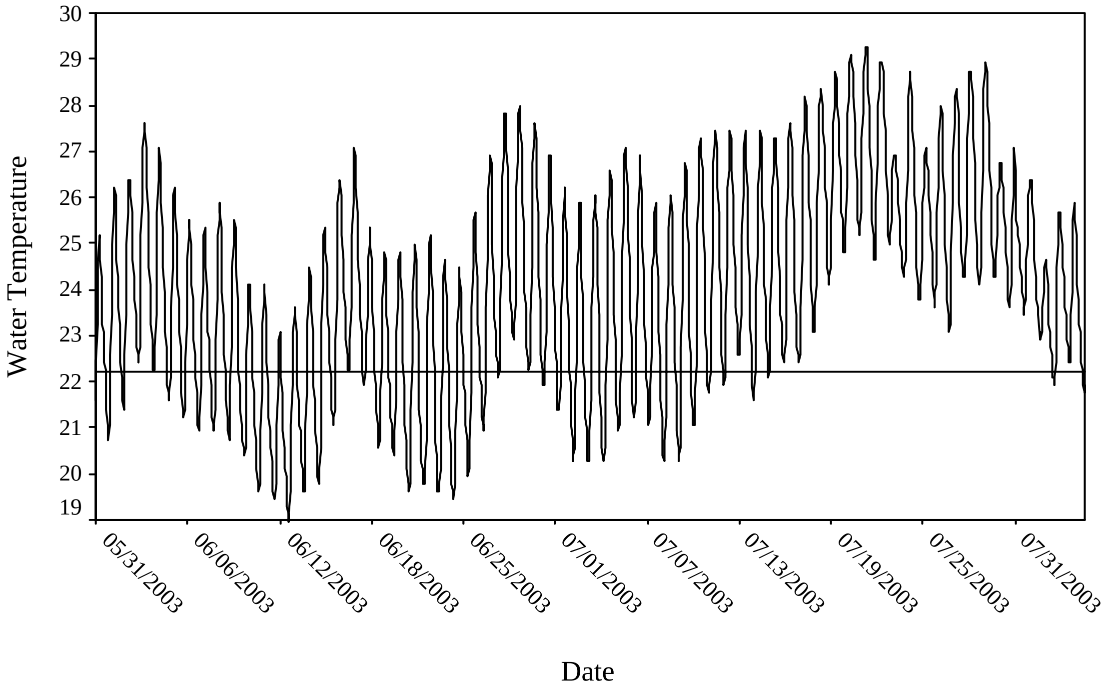
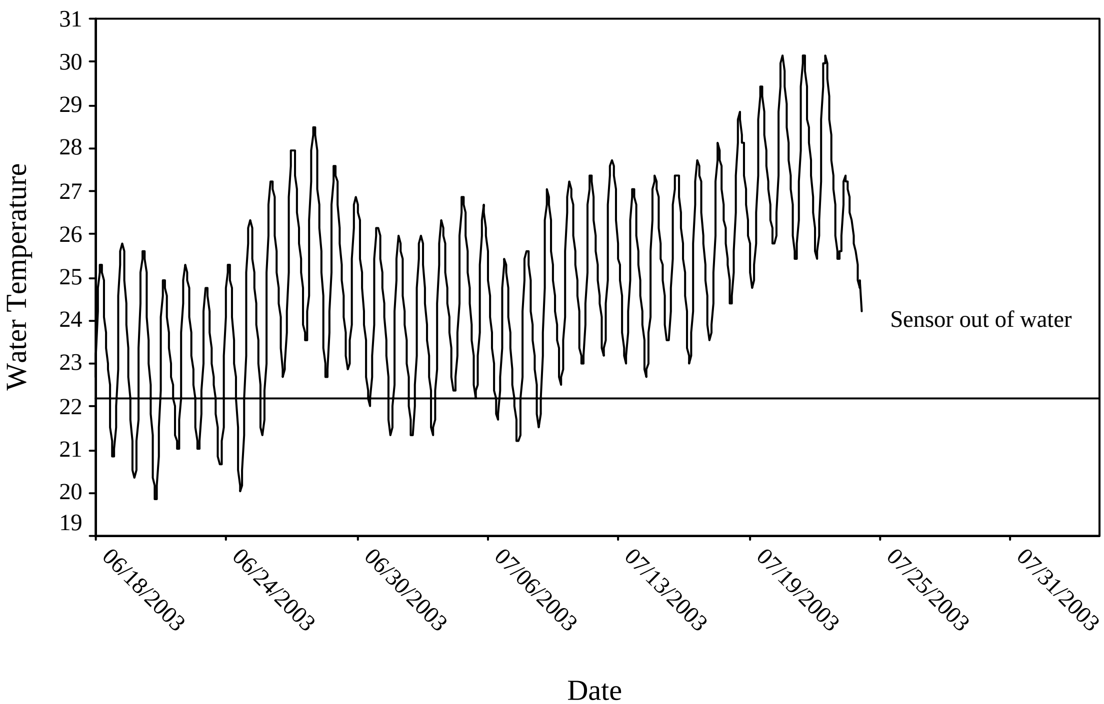


Figure 10. Water temperature time series for Miners Ravine at the Olympus Point site, during the period June 18 through July 24, 2003. Temperatures are marginal to suitable for juvenile rearing, depending on the availability of thermal refugia.



C. <u>Benthic Invertebrate Data</u>

Members of the Dry Creek Conservancy conduct the sampling program for benthic macroinvertebrates. Sampling data from 2000 at a single and unidentified site and two sampling sites in 2001 (Dick Cook Road and near the confluence with Secret Ravine) are presented in Appendix Dry Creek 1. These data indicate a high percentage of pollution tolerant organisms, with almost no organisms associated with cleaner waters. These results are not unexpected given the urban nature of the stream and the amount of sediment deposited in the channels of both streams. **Source: Dry Creek Conservancy, unpublished data.**

D. Physical Habitat Data

Physical habitat data consists of a single detailed study and several partial evaluations for Miners Ravine:

1. 1992-1993 Habitat Inventory by David Vanicek, Professor at California State University, Sacramento: The habitat inventory was limited to one reach [*Vanicek's report describes two reaches for Miners Ravine, upper (UMR) and lower (LMR), with the lower reach running from the Secret Ravine confluence downstream to the Antelope Creek confluence. However, I have described the lower reach in the Dry Creek analysis, using the reach identifiers from the 2002 Miners Ravine Habitat Assessment report by the Department of Water Resources*]. An explanation of the terminology used in the reach descriptions follows the actual descriptions. Vanicek describes this 4030 meter reach [UMR] as follows:

> "Reach UMR: Reach runs from the confluence with Secret Ravine upstream 4030 m to the city limit, which is about half way between Roseville Parkway and Sierra College Blvd. Description: Riffles, flatwater, considerable pool habitat due to many beaver dams; several marginal spawning sites in lower reaches; much overhanging vegetation; various low water barriers; low flow in summer a constraint; Overall quality: 4."

Vanicek defines flatwater as the same as would be considered a glide in most other methodologies. **Source: Fisheries Habitat Evaluation Dry Creek, Antelope Creek, Secret Ravine, and Miners Ravine (Task I); Prepared for EIP Associates by C. David Vanicek, CSUS Hornet Foundation, August 1993, Copy from CDFG files, Region 2.**

2. 1997 Spawning Gravel Survey by John Nelson, Department of Fish and Game: Nelson surveyed the stream from the confluence with Secret Ravine to approximately 1.5 miles upstream in 1997. He visually estimated the amount of spawning gravel 2-13 cm in diameter (3/4–5") and percentage of embeddedness. His conclusions were that the quantity of spawning gravel was limited and that embeddedness was >50%. **Source: 9/27/97 Memorandum from John Nelson, CDFG, Region 2 files.**

3. November 2001-February 2002 Habitat and Fish Passage Assessment by Department of Water Resources: Department of Water Resources surveyed 12.9 miles of the main channel from Secret Ravine upstream to near where King Road intersects Auburn Folsom Road in Loomis. This survey was conducted using a Level II Department of Fish and Game survey protocol. Sampling frequency was based on three habitat types (pool, riffle, glide) with each third occurrence of a particular habitat type receiving full documentation. Summary information is presented on a variety of parameters and includes a list and evaluation of potential fish passage impediments or barriers (potential barrier information will be presented in the fish passage section of this report). Specific habitat parameters measured included:

1. flow at the time of survey
2. habitat type
3. particle embeddedness
4. in-stream cover
5. substrate composition
6. canopy
7. observations of live salmon or carcasses

Key data from the Department of Water Resources report include:

- Substrate composition was recorded as gravel (particle diameter 0.08-2.5") and cobble (2.5-10"). These distinctions are too gross to allow for determining the potential quantity and spatial extent of sediments suitable for steelhead and chinook salmon spawning.

- The entire channel has at least 25 percent canopy cover.

- Table 5 shows that 44% of the channel length surveyed is glide habitat, with 35%pools and 21% riffles. Unfortunately, the summary data and Map 3 do not permit an assessment of the geographic distribution of the habitat types. In addition, it is not possible to characterize individual habitat types and the change in types from downstream to upstream. More detailed information is probably available from the author.

- Mean substrate embeddedness for the three habitat types is 54%, 66%, and 83% for riffles, glides, and pools, respectively.

- Thirteen different in-stream cover types were recorded, but each of the three habitat types is dominated by only 3 of the 13 cover types. Somewhat surprising is the large percentage of large woody debris, boulders, and overhanging branches that make up the in-stream cover.

- Dominant substrate composition for the three habitat types ranges from 51-78% sand, silt or clay. This indicates an extremely heavy sediment load in the channel.

- Approximately 90% of pools, 65% of glides, and 35% of riffles are greater than 2 ft. deep, which indicates potentially good rearing and holding habitat for juvenile salmonids.

Source: Miners Ravine Habitat Assessment, Department of Water Resources, Chris Lee, author, October 2002.

4. 2003 Foot Survey by Randy Bailey, Bailey Environmental: During January and February of 2003, I conducted two foot surveys for chinook salmon from the confluence with Secret Ravine upstream to the bicycle path crossing near Orivetto Drive in Roseville [*the 2002 Miners Ravine Habitat Assessment states that in 1965, Eric Gerstung from the Department of Fish and Game found live salmon and carcasses during the period mid-February through mid-March in Miners Ravine. I conducted these surveys to confirm this conclusion. In October 2003, I discussed the data with Chris Lee (author of the report) to ascertain where he had found the records. We reviewed the information and determined that he had misinterpreted Gerstung's data, which was really a fry trapping program.]*. While no quantitative data were collected, my analysis of this reach of Miners Ravine is as follows:

This reach of stream covers about 2 linear miles and contains a variety of habitat types. Probably 25-30% of the length has overhanging vegetation, ranging from dense clumps of blackberry to oak trees. There are numerous pools (formed by beaver dams), natural deposition areas, and some bedrock features. The bottom substrate is fairly large cobble, mostly > 6" in diameter, which makes it unsuitable for chinook salmon and steelhead spawning, since in this watershed these fish tend towards the small size for their species. Also, the gravel/cobble substrate is heavily embedded with sand and silt-sized particles. There are some locations where habitat complexity is good and if water temperatures were suitable, would constitute good rearing habitat for salmonids. However, the wetlands complex near Orivetto Drive may be a major contributor to high summer water temperatures downstream. Overall, this reach may be characterized as fair to good habitat for chinook salmon, with the potential to become excellent habitat with some source control on sediment and a reduction in gravel diameter and embeddedness. **Source: Randy Bailey, Bailey Environmental, pers. comm.**

5. 2003 Placer County Stream Videography Project: On March 12, 2003 Miners Ravine was videotaped from the air. While the footage is informative, the amount of riparian canopy limits the effectiveness of this source in analysis of Miners Ravine, particularly when compared to the detailed information contained in the 2002 Department of Water Resources report.

E. <u>Fishery Resource Data</u>

1. Documented Fish Species Present in the Stream

Goldfish	Hitch
Lamprey sp.	Golden shiner
Largemouth bass	Sacramento sucker
Sacramento perch	Brown bullhead
Green sunfish	Bluegill

Fall-run chinook salmon (native)
Fall-run chinook salmon (introduced)
Steelhead/rainbow trout
Sacramento pikeminnow (formerly known as Sacramento squawfish)
Source: California Department of Fish and Game, Region 2 files; DEIR Northeast Roseville Specific Plan, City of Roseville, October 1986; Placer County Flood Control and Water Conservation District, FPEIR Dry Creek Water Flood Control

Program, October 1994; November 5, 2001 Memorandum from CDFG Biologist Rob Titus, CDFG, Region 2 files; May 25, 1965 Memorandum from CDFG Biologist Eric Gerstung, CDFG, Region 2 files.

2. Fish Stocking Records

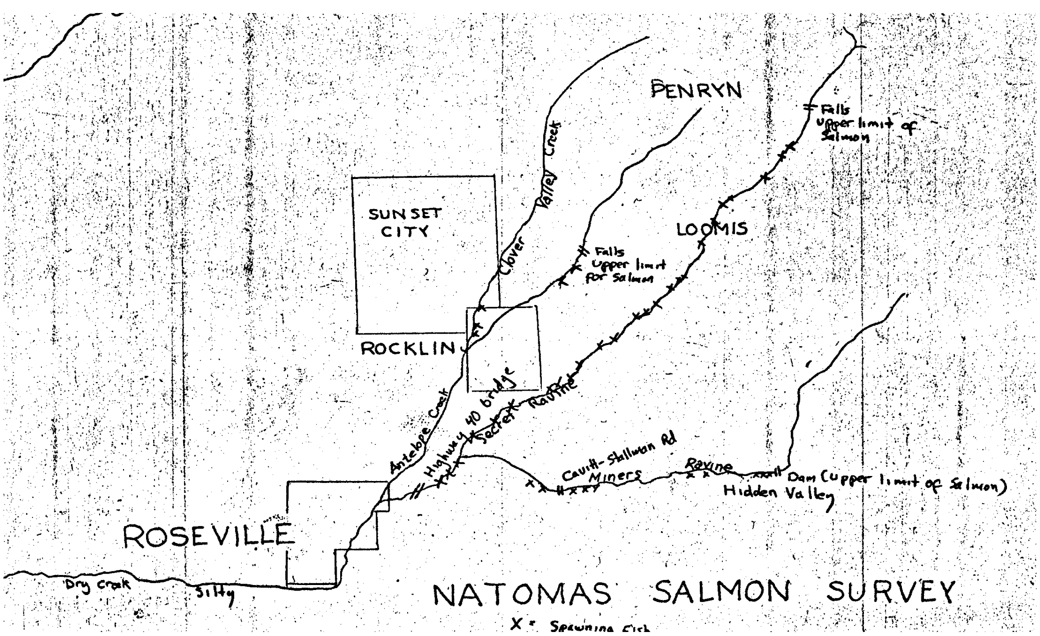
Only two records of fish stocking were found in Department of Fish and Game files. These records are:

- 1/12/89 – 100,678 Feather River Fish Hatchery origin fall-run chinook salmon fry, weighing 1,072 fish/lb. (37 mm mean length) at Sierra College Blvd.
- 2/19/93 – 50,095 Nimbus Fish Hatchery origin fall-run chinook salmon fry, weighing 1,165 fish/lb. (36 mm mean length) at Tall Pines Drive.

3. Adult Spawning Timing, Distribution, and Population Estimates

- **1964 Fall-run Chinook Salmon Spawning Survey by Eric Gerstung:** Gerstung conducted a survey of 1,000 ft. of stream (500 ft. near Cavitt Stallman Road and 500 ft. in "Hidden Valley") on 11/23/64. Figure 11 shows the sections surveyed. He reported 3 carcasses and 2 live fish at Cavitt Stallman Road and 4 carcasses and 1 live fish in Hidden Valley. He estimated the run size to be 100 fish and indicated that the run size was similar to 1963, although no specific reference to any particular stream was noted. Water clarity was reported as clear and flow estimated at 10 cfs. **Source: May 25, 1965 memorandum in CDFG, Region 2 files.**

Figure 11. Location of 1964 salmon spawning surveys conducted by Eric Gerstung. This figure shows that he found fish spawning in Miners Ravine.



- **December 6, 1985 Spawning Survey:** Miners Ravine was surveyed for fall-run chinook salmon on 12/6/85. The stream was surveyed from the confluence with Antelope Creek to approximately1.5 miles upstream [*This stream reach includes the segment identified by Vanicek as "Lower Miners Ravine" and included in this document as part of Dry Creek. However, results of this particular spawning survey are reported here and not in the Dry Creek analysis*]. No live fish were seen, but five female carcasses and one male carcass were seen and measured. The five female carcasses measured 54, 60, 64, 65, and 83 cm fork length; while the male carcass was 59 cm fork length. **Source: 12/19/85 Memorandum from CDFG Biologist Phil Hanson, CDFG, Region 2 files.**

- **11/27/91 Survey Request from a CDFG Warden:** The Warden reported that a "source" claimed that 49 adult chinook salmon were in Dry Creek and Miners and Secret ravines, with most in Secret Ravine. A survey the next week found no adults or redds in Miners or Secret ravines. **Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.**

- **1992-1993 Habitat Inventory by David Vanicek, Professor at California State University, Sacramento:** Vanicek reports conducting surveys along Miners Ravine in December 1992 and January 1993. No live fish were seen, but one carcass was observed on January 10, 1993 about 100 meters upstream of the confluence with Secret Ravine. **Source: Fisheries Habitat Evaluation Dry Creek, Antelope Creek, Secret Ravine, and Miners Ravine (Task I); Prepared for EIP Associates by C. David Vanicek, CSUS Hornet Foundation, August 1993, Copy from CDFG files, Region 2.**

- **11/24/93 Foot Survey from Sierra College Blvd. Downstream to Royer Park in Roseville:** A foot survey was conducted from Sierra College Blvd. downstream to Royer Park in Roseville. No fish were seen. **Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.**

- **11/14/96 Warden Report:** A warden reported seeing 4 live adults and one carcass just upstream of the Sunrise Blvd. Bridge in Roseville. **Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.**

- **1997 Spawning Gravel Survey by John Nelson, Department of Fish and Game:** Nelson surveyed the stream from the confluence with Secret Ravine to approximately 1.5 miles upstream in 1997. In this memorandum Nelson notes that the historical spawning run size in the Dry Creek Watershed is more than 1,000 fish with more than 60% occurring in Secret Ravine and more than 10% of the run occurring in Miners Ravine. **Source: 9/27/97 Memorandum from John Nelson, CDFG, Region 2 files.**

- **2000 E-mail Regarding Salmon Distribution:** This e-mail indicates that Gordon Cook, a caretaker at Hidden Valley, speared salmon in the 1960's near Cottonwood Dam. **Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.**

- **November 2001-February 2002 Habitat and Fish Passage Assessment by Department of Water Resources:** Department of Water Resources surveyed 12.9 miles of the main channel from Secret Ravine upstream to near where King Road intersects Auburn Folsom Road in Loomis. During the course of the survey, they counted 14 carcasses and 3 live fish between November 20 and December 3, 2001. Although only GPS coordinates are given for the fish locations, it appears that all fish seen were downstream of the wetlands complex near Orivetto Drive in the City of Roseville. [*In the Biological Inventory Results section of Lee's report, three reports of adult chinook salmon in Miners Ravine are documented. First, "In 1965, DFG carcass surveys counted 27 adult Chinook salmon (Gerstung)." However, no citation is included in the references and no corresponding information was found in the CDFG files that I examined. Second, Lee reports that the 1992-93 surveys completed by Vanicek reported 10 carcasses in Miners Ravine; this is probably a typographic error, since Vanicek's report only documents 1 carcass. Third, Lee reports that Gerstung found "11 live fish and 17 carcasses" during surveys conducted February 16 to March 12, 1965. This information would suggest that adult chinook salmon are spawning in Miners Ravine at a time when no other known chinook salmon race in the Central Valley spawns. Based on review of the original reference, Lee apparently misinterpreted Gerstung's field data sheet information as adult chinook salmon spawning adults and carcasses, when Gerstung was actually reporting data on salmon fry. I confirmed this conclusion with Lee on 10/31/2003*.] **Source: Miners Ravine Habitat Assessment, Department of Water Resources, Chris Lee, author, October 2002.**

- **Summary of Dry Creek Conservancy Fall-run Chinook Salmon Surveys in Miners Ravine:** Dry Creek Conservancy members have been conducting foot surveys during the fall and early winter since 1997. Three reaches are described:

  1. Miner Ravine 1 (MR1): Confluence with Secret Ravine upstream to East Roseville Parkway Bridge (approximately 5,200 ft.)
  2. Miners Ravine 2 (MR2): East Roseville Parkway Bridge upstream to Sierra College Blvd. (approximately 9,200 ft.).
  3. Miners Ravine 3 (MR3): Within the Miners Ravine Nature Preserve near the southernmost Auburn Folsom Road crossing (approximately 4 miles upstream from Sierra College Blvd.).

  Surveys usually begin about November 1 and continue until late December. No data has been reported for reach MR3. Two surveys were conducted in 1997, both in reach MR2, eight days apart with a total of 12 live fish and 5 carcasses reported. One survey was conducted on 11/15/98 in reach MR1 with 8 live fish reported. Figure 12 displays data for live and carcasses for 1999 (MR1 and MR2). Figures 13, 14, and 15 show the data for the years 2000, 2001, and 2002, respectively. Surveys have not been systematic or comprehensive, making population assessments impossible. **Source: Dry Creek Conservancy; unpublished data; Placer County Flood Control and Water Conservation District and Sacramento County Water Agency, Final Report: Dry Creek Watershed Flood Control Plan, April 1992, Table 5-1, reach lengths only.**

Figure 12. Summary of 1999 fall-run chinook salmon sampling surveys in Miners Ravine.

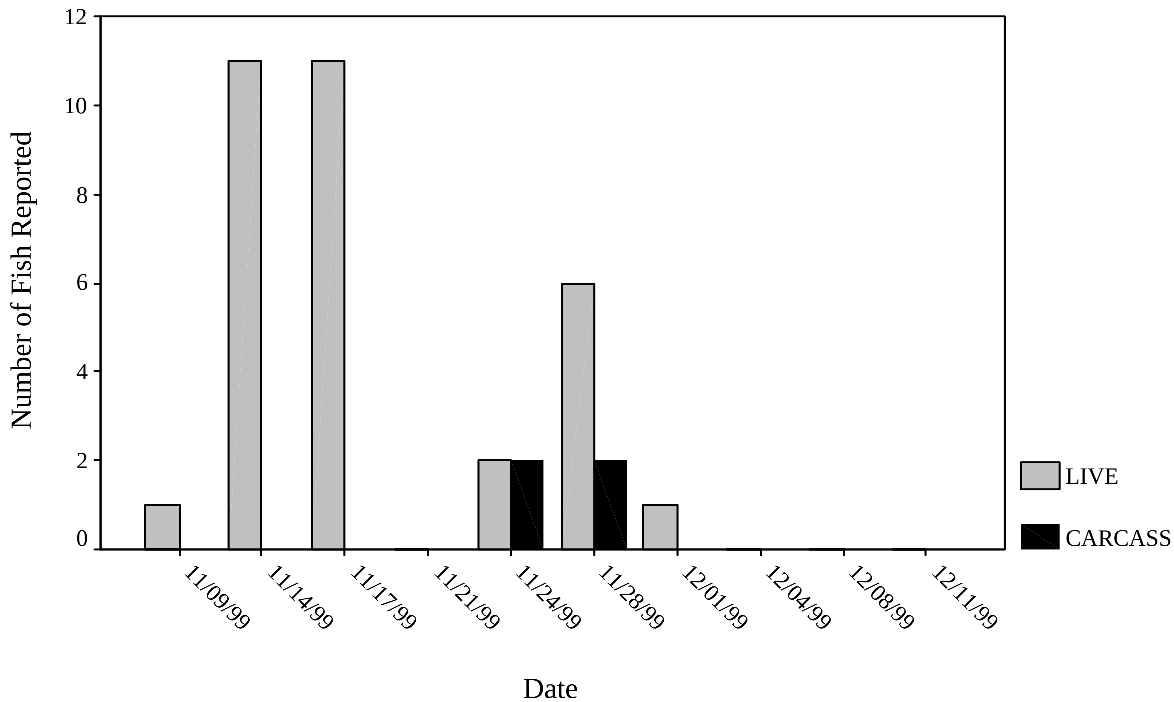


Figure 13. Summary of 2000 fall-run chinook salmon sampling surveys in Miners Ravine.

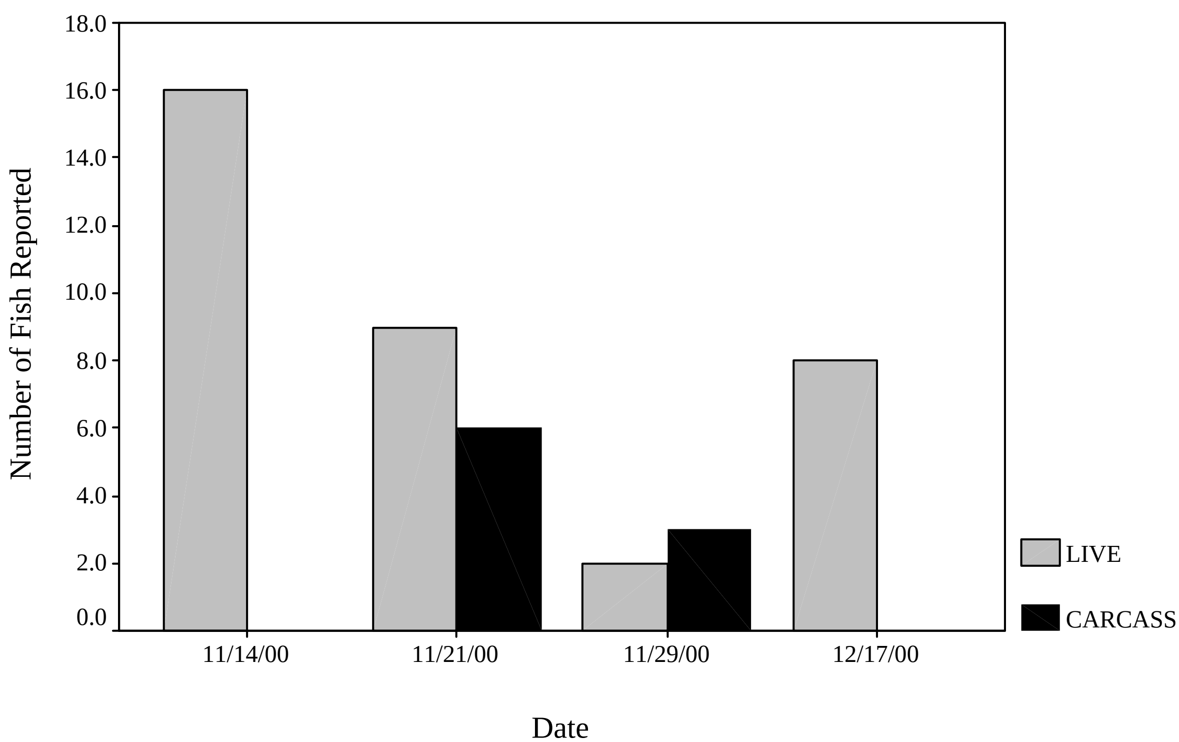


Figure 14. Summary of 2001 fall-run chinook salmon sampling surveys in Miners Ravine.

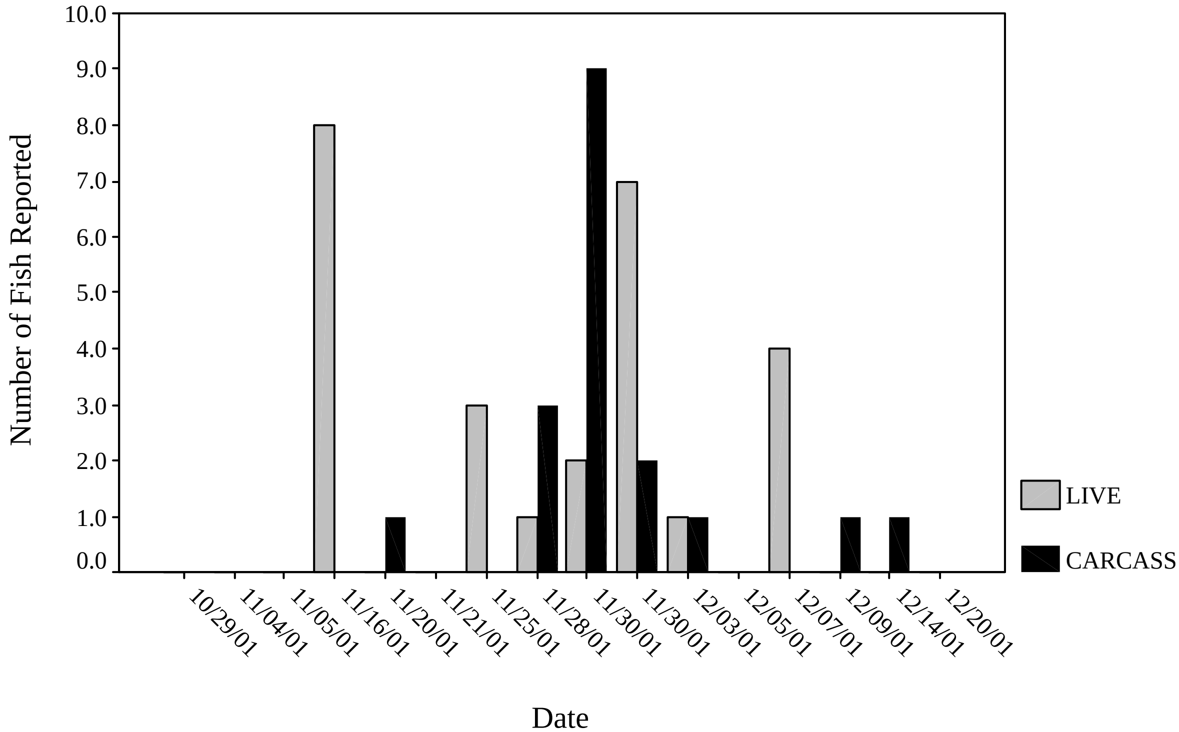
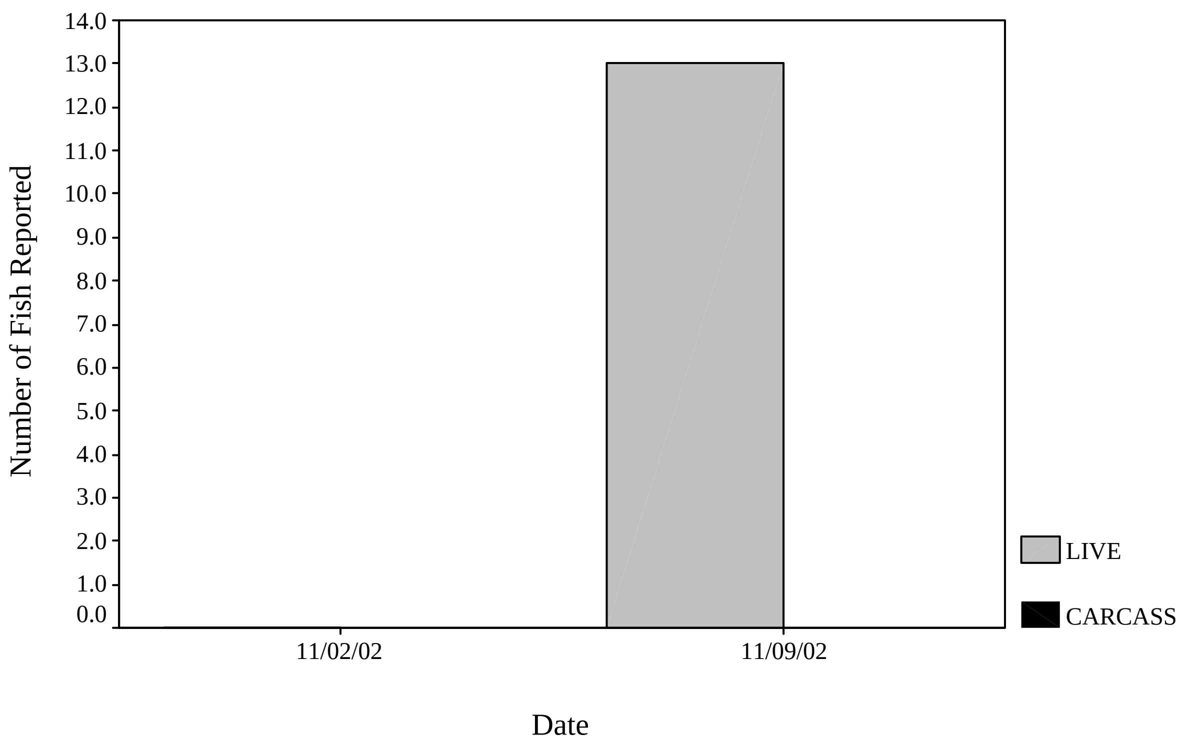


Figure 15. Summary of 2002 fall-run chinook salmon sampling surveys in Miners Ravine.



4. Juvenile Distribution and Sampling Data

- **Spring 1965 Fall-run Chinook Salmon Juvenile Emigration Survey by Eric Gerstung:** Gerstung began trapping for downstream migrant fall-run chinook salmon juveniles in Miners Ravine at a site about 100 yards downstream of Sierra College Blvd. on February 16, 1965 and continued through March 12, 1965. Sampling was with a "riffle" trap or perforated plate trap. The trap fished a total of 567 ¼ hours and captured 11 juvenile chinook salmon alive, with 17 dead recorded. Catch composition is noted as 10 crayfish, 1 brown bullhead, 3 green sunfish, 29 goldfish, 2 suckers, 5 hitch, 1 rainbow trout, 3 lamprey, and 1 squawfish. Water temperatures were reported as ranging from 45-55 ^{O}F during this time period. **Source: May 25, 1965 memorandum in CDFG, Region 2 files; handwritten draft of May 25, 1965 memo, and other handwritten notes.**

- **April 1986 One-time Electrofishing Event:** Jones and Stokes Associates conducted a one-time electrofishing event at two locations within the "plan area". Two 50-meter reaches were electrofished for a total of 1 hour. Flows were characterized as "high". Catch composition is presented in Table 2. **Source: DEIR, Northeast Roseville Specific Plan, October 1986.**

Table 2. Catch composition from a one-time electrofishing event at two locations on Miners Ravine during April 1986.

Species	Size Range (mm)	Number Captured
Sacramento pikeminnow (formerly squawfish)	68-189	9
Bluegill	69-120	3
Sacramento perch	48-54	2
Green sunfish	60-65	2
Steelhead trout	88-91	2
Brown bullhead	92	1

Source: DEIR, Northeast Roseville Specific Plan, October 1986.

- **1998-2000 Sampling in Miners Ravine by Rob Titus, California Department of Fish and Game:** Titus' sampling consisted of electrofishing to determine distribution of rearing juvenile steelhead and rotary screw trapping to determine emigration timing. Sections of Miners Ravine, from the confluence with Secret Ravine upstream to King Road, were electrofished between November 5, 1998 and June 8, 1999. The rotary screw trap was placed about 100 m downstream of the confluence with Secret Ravine and fished from November 6, 1998 through June2, 1999 and from January 9, 2000 though June 8, 2000.

  Electrofishing only captured juvenile steelhead at the Dick Cook Road site and not at any other locations, upstream or downstream. Twelve juvenile steelhead were captured during two sampling events (mid-December 1998 and late March 1999) ranging in length from 72 to 400 mm FL and averaged 211 mm. These data indicate the presence of young-of-the-year steelhead as well as rearing yearling and older steelhead. Juvenile chinook salmon were captured in each of six sections from the stream mouth upstream to above the fourth bicycle-trail crossing in the City of Roseville's Greenway. Titus also concludes that Cottonwood Dam is a barrier to steelhead migration, but some fish must pass under higher flows, since juveniles were found upstream of the dam. Captures in the rotary screw trap included three fish (177-212 mm FL) between March 14th and April 7, 1999 and 10 smolts (160-238 mm FL) from Mar3, 2000 through April 28, 2000.

Titus's conclusions regarding Miners Ravine were:

> "One notable difference between Secret and Miners ravines that may serve as an overall index of habitat quality for juvenile steelhead rearing was the composition of the fish fauna in each creek. Fishes in Secret Ravine transitioned from a spotted bass/Sacramento pikeminnow/Sacramento sucker dominated fauna in its lowermost reaches to a predominately native fish fauna including steelhead and lamprey in its upper reaches. In contrast, there was no longitudinal trend in catch composition on Miners Ravine. With the exception of juvenile steelhead at the Dick Cook road site, fishes were typically dominated by one or a combination of introduced warmwater species including cyprinids (namely golden shiners) and centrarchids (largemouth bass, bluegill, and other species) and proportionately very few observations of Sacramento pikeminnow and Sacramento sucker. That the fish fauna was so variable from site to site and consisted primarily of introduced warmwater fishes (except when juvenile chinook salmon were present in the creek below Cottonwood Dam) suggest that localized habitat conditions in the creek may also be highly variable, possible as a function of water quality and pond development within the system. Localized dominance of especially golden shiner may be indicative of high temperature and low dissolved oxygen conditions that are unsuitable for the native fishes in the system, especially steelhead."

Titus's conclusions about water quality are supported by the data presented in the water quality section of this report. **Source: Memorandum from CDFG Biologist Rob Titus dated November 5, 2001, CDFG, Region 2 files.**

E. Fish Passage or Screening Data

Potential fish passage problems and locations are well documented in the "Miner Ravine Habitat Assessment" report from the Department of Water Resources. Since this was an on-the-ground assessment, complete with GPS coordinates, measurements of the individual potential barriers (e.g., beaver dams, flashboard dams, waterfalls, etc.) and physical descriptions and photos, this assessment is probably definitive. The DWR report documents 38 potential barriers in the area surveyed. **Source: Miners Ravine Habitat Assessment, Department of Water Resources, Chris Lee, author, October 2002.**

APPENDIX MINERS RAVINE 1

BENTHIC MACROINVERTEBRATE DATA
COLLECTED BY THE DRY CREEK CONSERVANCY

Miner's Ravine Benthic Macroinvertebrate Samples 2000 - 2001

			Miner's Ravine				Miner's Ravine @ Secret Ravine				Miner's Ravine @ Dick Cook Rd.			
SAMPLING STATION:			2000				2001				2001			
REPLICATE #	TV	FFG	48	49	50	Total	61	62	63	Total	73	74	75	Total
PHYLUM ARTHROPODA														
Class Insecta														
Coleoptera (Larvae)														
Elmidae	4	c												
Dubiraphia sp.	6	c												
Microcylloepus sp.	4	c												
Diptera														
Ceratopogonidae	6	p												
Bezzia sp./ Palpomyia sp.	6	p												
Dasyhelea sp. (pupa)	6	nf												
Chironomidae	6													
Chironominae														
Chironomini	6	c	1			1		1		1				
Pseudochironomini	5	c												
Tanytarsini	6	c	140	72	98	310	218	142	190	550	50	45	27	122
Orthocladiinae	5	c	1	4	2	7	13	11	6	30	16	7	7	30
Tanypodinae	7	p					1			1	3		1	4
Empididae	6	p												
Clinocera sp.	6	p												
Hemerodromia sp.	6	p												
Neoplasta sp.	6	p												
Muscidae	6	p												
Limnophora sp.	6	p												
Simuliidae	6	f												

Simulium sp.	6	f	6	35	17	58	3	54	16	73	28	117	37	182
Tipulidae	3													
Limonia sp.	6	s												
Hemiptera														
Corixidae	8	p												
Sigara sp.	8	p												
Megaloptera														
Sialidae	4	p												
Sialis sp.	4	p												
Odonata														
Calopterygidae	5	p												
Hetaerina sp.	6	p		1		1					1			1
Coenagrionidae		p												
Argia sp.	7	p	6	5	3	14	3	5	3	11	19	8	2	29
Gomphidae	4	p												
Ophiogomphus occidentis.	4	p					1			1	1			1
Libellulidae	9	p												
Brechmorhoga mendax	9	p	1		1	2		1		1			1	1
Lepidoptera														
Nepticulidae		s												
Pyralidae	5										2			2
Petrophila sp.	5	g			4	4	1	2	3	6				
Ephemeroptera														
Baetidae	4	g												
Baetis sp.	5	c	22	55	72	149	6	21	20	47	19	48	56	123
Camelobaetidius sp.	4	c			1	1								
Fallceon quilleri	4	c		1		1		1		1				
Caenidae	7	c												
Caenis sp.	7	c												

Ephemerellidae	1	c												
Eurylophella lodi	1	c												
Leptohyphidae	4	c												
Tricorythodes minutus	4	c	3			3					12	2	3	17
Plecoptera														
Chloroperlidae	1	p												
Perlodidae	2	p												
Isoperla sp.	2	p												
Trichoptera														
Glossosomatidae	0	g												
Protoptila coloma	1	g	2			2								
Helicopsychidae	3	g												
Helicopsyche borealis	3	g												
Hydropsychidae	4	f												
Hydropsyche californica	4	f	92	71	101	264	9	22	15	46	32	8	71	111
Hydroptilidae	4	g												
Hydroptila sp.	6	g			1	1	4		5	9				
Leucotrichia pictipes	6	g		1		1	1		1	2				
Ochrotrichia sp.	4	c												
Oxyethira sp.	3	c					1			1				
Lepidostomatidae	1	s												
Lepidostoma sp.	1	s												
Leptoceridae	4	c												
Mystacides alafimbriata	4	c												
Nectopsyche gracilis	3	c											1	1
Triaenodes/Ylodes sp.	6	s												
Philopotamidae	3	f												
Chimarra sp.	4	f	2	1	3	6		1		1				
Wormaldia sp.	3	f						2		2		1		1
Subphylum Chelicerata														

Class Arachnoidea														
Acari														
Hygrobatidae	8	p												
Hygrobates sp.	8	p												
Megapella sp.	8	p										1	1	2
Lebertiidae	8	p												
Lebertia sp.	8	p												
Sperchontidae	8	p												
Sperchon sp.	8	p	3	6	2	11	2	1	3	6	21	10	40	71
Torrenticolidae	5	p												
Torrenticola sp.	5	p		1		1								
Subphylum Crustacea														
Class Malacostraca														
Amphipoda														
Cragonyctidae	4	c												
Crangonyx sp.	4	c		1		1	1	1	1	3	22	8		30
Stygobromus sp.	4	c												
Hyalellidae	8	c												
Hyalella sp.	8	c												
Decapoda														
Astacidae	8	c												
Pacifasticus leniculus	6	c						1		1				
Class Ostracoda														
Ostracoda	8	c												
Cyprididae	8	c		1		1	1			1	1			1
PHYLUM COELENTERATA														
Class Hydrozoa														
Hydroida														
Hyridae														
Hydra sp.	5	p												

PHYLUM MOLLUSCA													
Class Gastropoda													
Pulmonata													
Ancylidae	6	g											
Ferrissia sp.	6	g	14	22	4	40	1	2	39	42				
Lymnaeidae	6	g												
Fossaria sp.	8	g												
Physidae	8	g												
Physa sp./ Physella sp.	8	g									1		1	2
Planorbidae	6	g												
Gyraulus sp.	8	g												
Helisoma sp.	6	g	1			1	1		7	8				
Micromenetus sp.	6	g	1		1	2								
Class Bivalvia														
Pelecypoda	8	f												
Corbiculidae	10	f												
Corbicula fluminea	10	f		1		1	2	1	1	4	4	5	12	21
Sphaeriidae	8	f												
Pisidium sp.	8	f												
PHYLUM NEMATODA	5	p		3	3	6	1	3		4	1	3	1	5
PHYLUM PLATYHELMINTHES														
Class Turbellaria														
Tricladida														
Planariidae	4	p												
Dugesia tigrina	4	p	3	2		5		3		3	10	4	9	23
PHYLUM ANNELIDA														
Class Oligochaeta	5	c	7	32	14	53	9	4	1	14	22	10	6	38
Megadrili	5	c												
PHYLUM NEMERTEA														
Class Enopla														

Tertastemmatidae														
Prostoma graecense	8	p	10	3	1	14	3	2		5	18	8	10	36
Total			315	318	328	961	282	281	311	874	283	285	286	854
Taxa Richness			18	20	17	29	21	21	15	28	20	16	18	24
Percent Dominant Taxon			44	23	31	32	77	51	61	63	18	41	25	21
EPT Taxa			5	5	5	9	5	5	4	8	3	4	4	5
EPT Index (%)			38.4	40.6	54.3	44.5	7.4	16.7	13.2	12.5	22.3	20.7	45.8	29.6
Sensitive EPT Index			0.6	0.0	0.0	0.2	0.4	0.7	0.0	0.3	0.0	0.4	0.3	0.2
Ephemeroptera Taxa			2.0	2.0	2.0	4.0	1.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0
Plecoptera Taxa			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trichoptera Taxa			3.0	3.0	3.0	5.0	4.0	3.0	3.0	6.0	1.0	2.0	2.0	3.0
Dipteran Taxa			4.0	3.0	3.0	4.0	4.0	4.0	3.0	5.0	4.0	3.0	4.0	4.0
Percent Dipteran			47.0	34.9	35.7	39.1	83.3	74.0	68.2	74.9	34.3	59.3	25.2	39.6
Non-Insect Taxa			7.0	10.0	6.0	12.0	9.0	9.0	6.0	11.0	9.0	8.0	8.0	10.0
Percent Non-Insect			12.4	22.6	7.6	14.2	7.4	6.4	16.7	10.4	35.3	17.2	28.0	26.8
Percent Chironomidae			45.1	23.9	30.5	33.1	82.3	54.8	63.0	66.6	24.4	18.2	12.2	18.3
Percent Hydropsychidae			29.2	22.3	30.8	27.5	3.2	7.8	4.8	5.3	11.3	2.8	24.8	13.0
Percent Baetidae			7.0	17.6	22.3	15.7	2.1	7.8	6.4	5.5	6.7	16.8	19.6	14.4
Shannon Diversity			1.7	2.1	1.7	1.9	1.1	1.7	1.5	1.6	2.6	1.9	2.2	2.4
Tolerance Value			5.3	5.3	5.1	5.3	5.9	5.7	5.8	5.8	5.7	5.8	5.7	5.7
Percent Intolerant (0-2)			0.6	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percent Tolerant (8-10)			4.4	3.5	1.2	3.0	2.8	1.8	1.3	1.9	15.9	8.4	22.7	15.7
Percent Collectors			55.2	52.2	57.0	54.8	88.3	64.8	70.1	74.3	50.2	42.1	35.0	42.4
Percent Filterers			31.7	34.0	36.9	34.2	5.0	28.5	10.3	14.4	22.6	46.0	42.0	36.9
Percent Grazers			5.7	7.2	3.0	5.3	2.8	1.4	17.7	7.7	0.4	0.0	0.3	0.2
Percent Predators			7.3	6.6	3.0	5.6	3.9	5.3	1.9	3.7	26.1	11.9	22.7	20.3
Percent Shredders			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Percentages			100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.3	100.0	100.0	99.8
Total Abundance			1890	1531	1312		1354	3372	1866		849	1140	1144	

Dry Creek Benthic Macroinvertebrate CSBP Summary Metrics, 2000 - 2001									
	Miner's Ravine			Miner's Ravine @ Secret Ravine			Miner's Ravine @ Dick Cook Rd.		
	2000			2001			2001		
	Mean	CV	Total	Mean	CV	Total	Mean	CV	Total
Taxa Richness	18.3	8.3	29.0	19.0	18.2	28.0	18.0	11.1	24.0
Percent Dominant Taxon	32.6	33.8	32.3	63.0	21.4	62.9	27.8	43.0	21.3
EPT Taxa	5.0	0.0	9.0	4.7	12.4	8.0	3.7	15.7	5.0
EPT Index (%)	44.4	19.4	44.5	12.5	37.6	12.5	29.6	47.5	29.6
Sensitive EPT Index	0.2	173.2	0.2	0.4	100.1	0.3	0.2	86.6	0.2
Ephemeroptera Taxa	2.0	0.0	4.0	1.3	43.3	2.0	2.0	0.0	2.0
Plecoptera Taxa	0.0	#DIV/0!	0.0	0.0	#DIV/0!	0.0	0.0	#DIV/0!	0.0
Trichoptera Taxa	3.0	0.0	5.0	3.3	17.3	6.0	1.7	34.6	3.0
Dipteran Taxa	3.3	17.3	4.0	3.7	15.7	5.0	3.7	15.7	4.0
Percent Dipteran	39.2	17.3	39.1	75.2	10.2	74.9	39.6	44.6	39.6
Non-Insect Taxa	7.7	27.2	12.0	8.0	21.7	11.0	8.3	6.9	10.0
Percent Non-Insect	14.2	54.0	14.2	10.2	55.7	10.4	26.8	34.0	26.8
Percent Chironomidae	33.2	32.7	33.1	66.7	21.1	66.6	18.3	33.2	18.3
Percent Hydropsychidae	27.4	16.4	27.5	5.3	44.5	5.3	13.0	85.5	13.0
Percent Baetidae	15.6	50.1	15.7	5.5	54.4	5.5	14.4	47.1	14.4
Shannon Diversity	1.8	12.3	1.9	1.4	20.8	1.6	2.2	14.4	2.4
Tolerance Value	5.3	2.5	5.3	5.8	1.7	5.8	5.7	1.4	5.7
Percent Intolerant (0-2)	0.2	173.2	0.2	0.0	#DIV/0!	0.0	0.0	#DIV/0!	0.0
Percent Tolerant (8-10)	3.0	54.3	3.0	2.0	40.3	1.9	15.7	45.6	15.7
Percent Collectors	54.8	4.4	54.8	74.4	16.6	74.3	42.4	17.9	42.4
Percent Filterers	34.2	7.5	34.2	14.6	84.6	14.4	36.8	33.9	36.9
Percent Grazers	5.3	39.7	5.3	7.3	123.1	7.7	0.2	86.6	0.2
Percent Predators	5.7	40.4	5.6	3.7	46.0	3.7	20.3	36.6	20.3
Percent Shredders	0.0	#DIV/0!	0.0	0.0	#DIV/0!	0.0	0.0	#DIV/0!	0.0

PLEASANT GROVE CREEK

The literature review for Pleasant Grove Creek <u>did not</u> result in any information related to:

- Existing Water Quality Data
- Water Temperature Data
- Benthic Macroinvertebrate Data
- Physical Habitat Data
- Fishery Resource Data
- Fish Passage or Screening Data

I reviewed all of the pertinent environmental documents produced by the cities of Rocklin and Roseville, talked with appropriate staff in the two cities, and searched the fisheries files at the California Department of Fish and Game's Region 2 office. Since Pleasant Grove Creek is currently intermittent, environmental documents focus on wetlands, vernal pools, and riparian issues, but not on water quality, benthic macroinvertebrates, or fishery resources. In fact, CDFG only has an empty file folder for Pleasant Grove Creek. However, I did visit all of the accessible road crossings over the various channels. During the stream videography project in March 2003, we did fly the main channel of Pleasant Grove Creek. Therefore, my assessment of this stream's potential to support anadromous fish is based on my limited road crossing observations and my flight observations. *[This assessment is basically repeated in the Assessment Report prepared for Placer County]*.

A. Water Quality

Assessment: Observations of water in the channel during the helicopter flight showed what appeared to be some minor turbidity and color. I suspect that the color is generated from the extensive wetlands in the upper portion of the watershed. At road crossings in the uppermost portion of the watershed, the stream channel is quite small, but water quality appeared good, although no information on metals or pesticide concentrations are available.

B. Water Temperature

Assessment: Although no data is available, my belief is that water temperatures, if perennial flow were to become the norm, would be unsuitable in summer for juvenile salmonid rearing in the portion of the watershed downstream of a point somewhere between Stanford Ranch Road and Wyckford Drive in Rocklin. The channel becomes shaded in a greenbelt and it is possible that water temperatures could support summer rearing of juvenile steelhead. In areas downstream, water temperatures would be unsuitable for salmonids. However, once the new City of Roseville wastewater treatment facility begins discharging water to the channel near Phillips Road, downstream temperature conditions could change things considerably.

C. Benthic Macroinvertebrates

Assessment: In the event the channel did become perennial at some future date, I speculate that the substrate would be composed of fine particles to coarse sand. This substrate would support a low diversity and numbers of organisms that would be suitable as a food source for salmonids. In the watershed upstream of Stanford Ranch Road, there is suitable substrate to support a more diverse invertebrate community and the sediment levels are lower than in downstream areas.

D. Physical Habitat

Assessment: This stream channel, in general, is very low gradient and the surrounding soils are mostly fine textured. Given these constraints, I do not believe that a significant majority of this stream could ever possess the physical characteristics to support salmonid species. However, there is a small percentage of the channel in the upper headwaters that may be able to support a small population of steelhead. I do not believe this stream could support chinook salmon. The size of the stream at the point where suitable physical conditions might develop is just too small to support chinook. In this upper portion of the watershed., stream gradient increases, which results in gravel and cobble beginning to appear as the channel substrate. The nature of the sediment changes from decomposed granite in downstream areas to a much finer soil/organic matter texture. The vast majority of the channel has a riparian zone in very poor condition and miles of eroding banks. Sediment load deposited in the channel is staggering in extent and volume.

Fishery Resources

Assessment: Based on the location, gradient, soils, and other factors associated with this channel, I believe that this stream has very low potential as an anadromous fish stream. The current conditions, and I believe most likely future conditions in the channel do not meet most, if any, of the requirements necessary to support anadromous fish. Although, conditions might change sufficiently in the future, to allow suitable habitat and flow volumes to support a very small population of steelhead in the uppermost portion of the watershed.

Fish Passage or Screening

Assessment: There are numerous diversions, a multitude of beaver dams, and man-made small earthen dams upstream of Highway 65. All of these potential barriers would need to be evaluated in the context of the potential steelhead habitat in the upper watershed. Not much bang for the buck in this stream channel.

SECRET RAVINE

A. Water Quality Data

1. 2001 and Periodic Water Quality Sampling, Central Valley Regional Water Quality Control Board: Periodic water quality information has been collected for three sites in the Secret Ravine Watershed. From December 2000 through February 2002, the Central Valley Regional Water Quality Control Board (Regional Board) staff conducted approximately monthly monitoring at Loomis Basin Park. The Regional Board collections also included pesticide scans with no problems noted. Water quality standards for selected metals (Table 1) indicate that standards for cadmium, copper, and zinc were exceeded in at least one sample (Table 2). One hardness measurement was taken at the time of sampling, but contemporary measurements indicate that hardness must have been near 50 mg/l for the other samples. Data on hardness in the stream over the course of the one-year of monthly monitoring ranged from 32-76 mg/l that demonstrate that the water quality standards at a hardness of 50 mg/l are applicable.

In addition, the fluctuations in pH values recorded by Regional Board sampling are also a concern. While the total magnitude of the annual change is not as great as recorded in other drainages, it is the rapidity at which the changes are taking place, particularly in the fall. This is the same pattern noted in adjacent streams and watersheds. Figure 1 displays the pH data from the Regional Board sampling at Loomis Basin Park. While the absolute values are within the accepted range for coldwater fish species, the fluctuations are quite high and additional sampling would help clarify the overall situation. **Source: Central Valley Regional Water Quality Control Board, unpublished data:**

Table 1. California Toxics Rule water quality standards for selected metals, based on a hardness of 50 mg/l as CaCO3.

Metal	Maximum Concentration (Acute) (mg/l)	Continuous Concentration (Chronic) (mg/l)
Barium	No standard	No standard
Cadmium	0.002	0.0013
Copper	0.007	0.005
Zinc	0.067	0.066

Source: California Toxics Rule (water quality objectives).

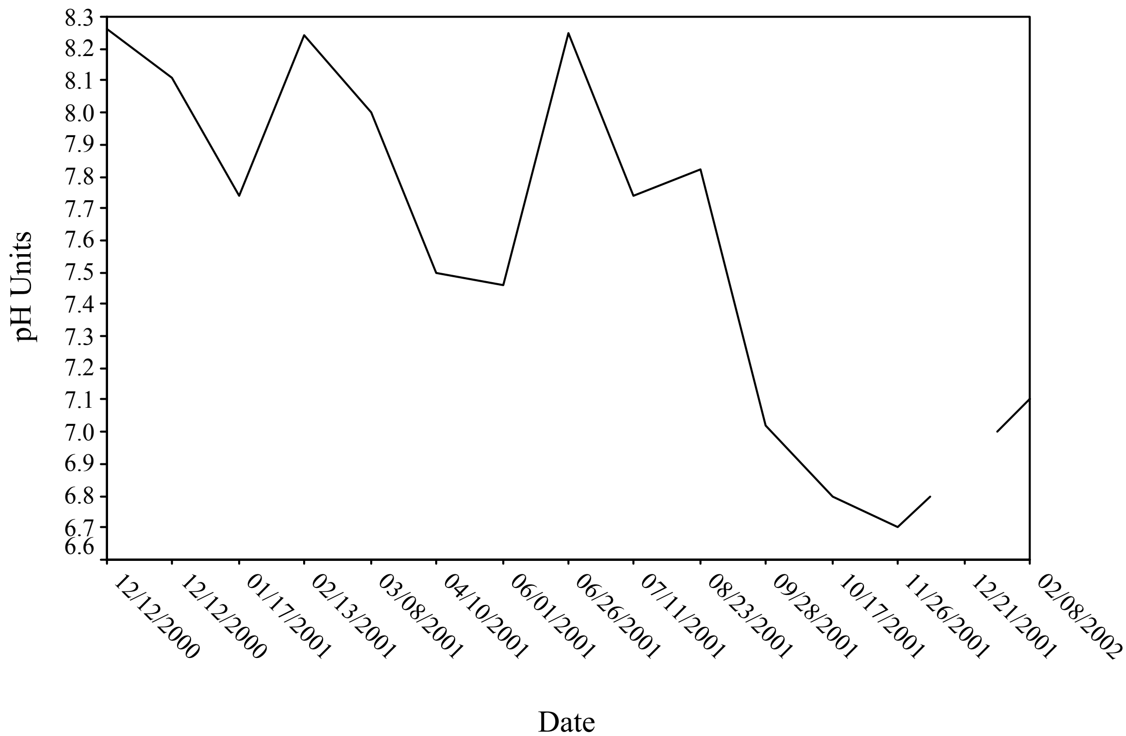
Table 2. Metal concentration data from two locations in Secret Ravine. This data shows that cadmium, copper, and zinc concentrations exceed the California Toxics Rules standards calculated for a hardness of 50 mg/l as CaCO3. **Values in bold exceed California Toxics Rule objectives for aquatic life at a hardness of 50 mg/l**.

Stream	Location	Date	Cadmium mg/l	Copper mg/l	Zinc mg/l	Notes
Secret Ravine	Secret Ravine above Rocklin Road	11/13/01	0.000	**0.005**	0.012	Hardness ≈ 32-76 mg/l
Secret	Secret Ravine at	11/13/01	0.000	**0.005**	0.015	Hardness ≈

Ravine	Miners Ravine					32-76 mg/l
Secret Ravine	Secret Ravine at Miners Ravine	11/08/02	**0.010**	**0.012**	**0.070**	Hardness = 47 mg/l

Source: Central Valley Regional Water Quality Control Board, unpublished data:

Figure 1. Monthly time series of pH data taken in Secret Ravine at Loomis Basin Park during the period December 2000 to February 2002.



2. Dry Creek Conservancy Sampling. The Dry Creek Conservancy (DCC) has conducted periodic "first flush" and/or quarterly monitoring upstream of Rocklin Road, and at the confluence with Miners Ravine. A variety of parameters are collected, but the data are not comprehensive or systematic for all parameters. The DCC data raise a concern about the ratio of nitrate to orthophosphate in the stream. Data from DCC sampling near Rocklin Road (Figure 2) and at the confluence with Miners Ravine (Figure 3) show the ratios are not consistent with the recommended 10:1 nitrate to orthophosphate. While the concentrations shown are not excessive, these data are quarterly and do not necessarily reflect the actual levels over the full year time period. Also, there is no comparable dissolved oxygen data to indicate if there are declines in dissolved oxygen levels during the night during summer and fall. It appears that phosphorus is not a limiting nutrient at this time and that additional inputs of nitrates from runoff and lawn fertilizers could create biostimulation and declines in dissolved oxygen levels. Additional sampling to clarify the situation should be a high priority. A complete set of all water quality data is available electronically from the DCC, while Bailey Environmental has a complete copy of the provisional data. **Source: Dry Creek Conservancy, unpublished data.**

Figure 2. Comparison of nitrate (NO3) and orthophosphate (PO4) concentrations from quarterly sampling near Rocklin Road.

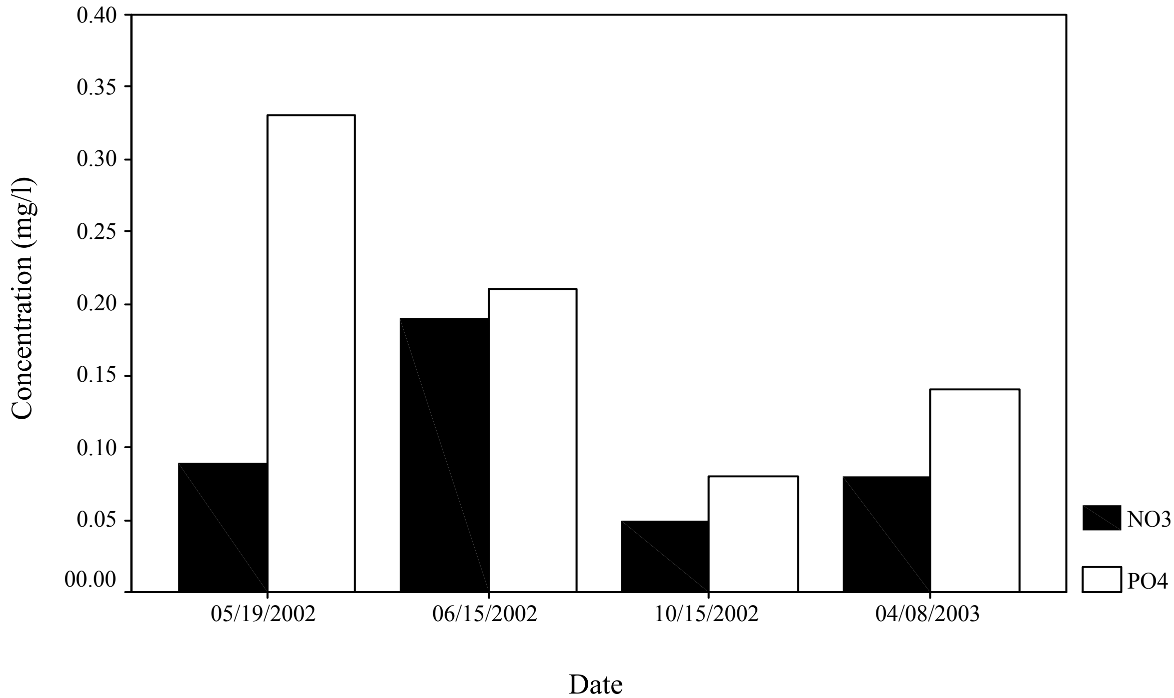
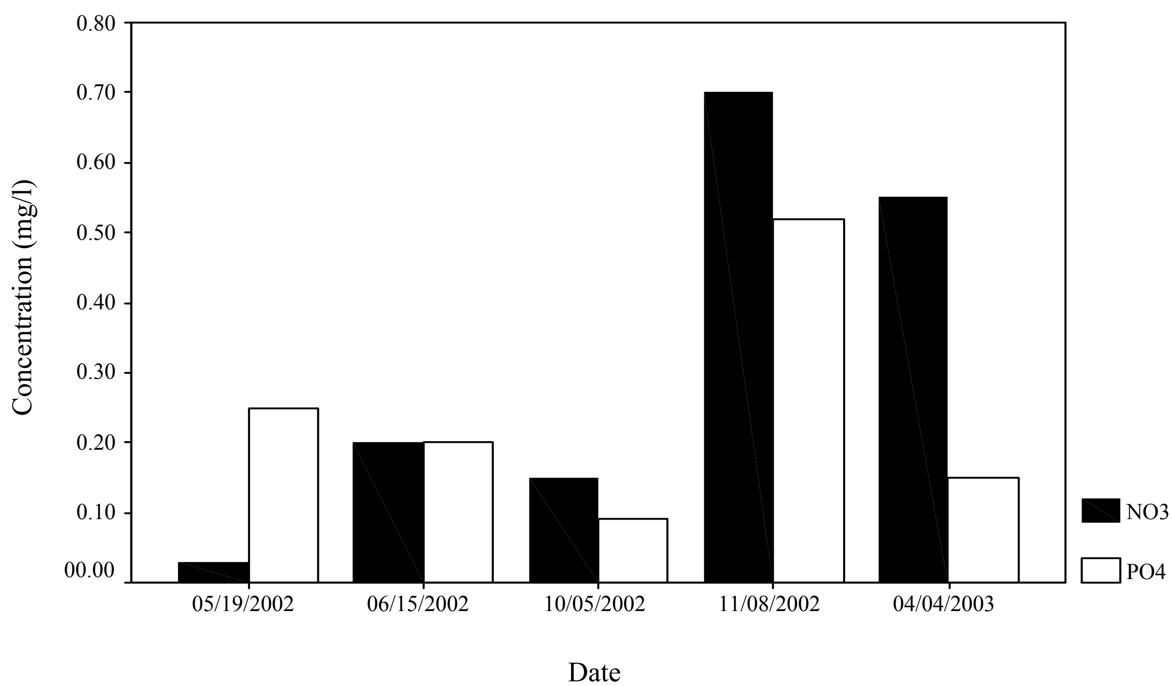


Figure 3. Comparison of nitrate (NO3) and orthophosphate (PO4) concentrations from quarterly sampling near the confluence with Miners Ravine.



B. Water Temperature Data

Water temperature data is limited, with the majority of the data coming from hourly monitoring funded by Placer County and conducted by Bailey Environmental. This sampling was initiated in late May 2003 and will continue for approximately one year. All data retrieved to date is plotted in Figures 3-6 below. Since daily maximum, minimum, and/or mean temperatures individually are of little value, I have chosen to plot all data points. Therefore, I have split the year into time periods that roughly correspond to:

Fall-early winter: September though December; primary fall-run chinook salmon spawning period is November-December.
Winter-spring: January though April; fall-run chinook salmon incubation and rearing and steelhead spawning, incubation, and rearing.
Late spring-summer: May to September; summer rearing for steelhead juveniles.

Data plots for these time periods are presented below to allow the reader to assess the potential of Miners Ravine to support chinook salmon and/or steelhead trout spawning and rearing. A variety of localized data and literature was reviewed to establish a generalized understanding of the potential for temperature effects on various life history stages for both chinook salmon and steelhead trout. There is fairly substantial variation in temperature effects noted for most life history stages. However, both chinook salmon and steelhead are have a highly adaptable physiology and ability to seek thermal refuge during part of the day which allows them to tolerate and/or avoid lethal temperatures. Some of the literature sources cite criteria from others and some of the data is based on fish captures with water temperature taken concurrently. Two tables with data and reference are included in Appendix A of this report. Based on this review, the following criteria have been used to indicate what life history stages a particular stream may support at any given time:

Chinook Salmon	**^{O}C**	**Steelhead Trout**	**^{O}C**
Egg and fry development	14.4 (58 ^{O}F)	Egg and fry development	14.4 (58 ^{O}F)
Juvenile rearing	21.1 (70 ^{O}F)	Juvenile rearing	22.2 (72 ^{O}F)
Adult migration	21.7 (71 ^{O}F)	Adult migration and holding	22.2 (72 ^{O}F)

Accordingly, reference lines at 14.4 ^{O}C and 22.2 ^{O}C have been plotted on Figures 4-9 to roughly represent the water temperatures suitable for salmonid spawning migration, egg and fry development, and juvenile rearing.

1. Rocklin and Brace Roads Juvenile Trapping Survey February 29 – May 24, 1984: Table 3 displays water temperature data from a short-term juvenile chinook salmon trapping program on Secret Ravine. **Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.**

Table 3. Water temperature measurements from two fish sampling locations on Secret Ravine during the spring of 1984.

Date	Time	Water Temp. (^{O}F)	Location
2/29/84	1230	50	Rocklin Rd.
3/6/84	---	63.5	Rocklin Rd.
5/2/84	0900	55	Rocklin Rd.
5/24/84	1000	64	Rocklin Rd.
2/29/84	1200	50	Brace Rd.
5/2/84	---	55	Brace Rd.

Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.

2. 1998-2003 Sampling in Miners Ravine by Rob Titus, California Department of Fish and Game: Titus' memorandum presents information on daily maximum and average water temperatures at more than one location in Miners Ravine over the period June 1, 1999 though August 31, 1999. He indicates that water temperatures spiked at 77 ^{O}F on three occasions in July 1999 and averaged 70 ^{O}F over the three-month period. I was able to obtain detailed data from Titus for their site at Gilardi Road near Newcastle for the period July 30, 2002 through August 27, 2003 and that data is displayed (2hour sampling intervals) in Figures 4-7 below. However, Titus has indicated that he has other detailed data for earlier years, but will not have time to supply the information until mid-December 2003. I have asked him to provide the data to me and I will in turn provide the data to Placer County. **Source: Memorandum from CDFG Biologist Rob Titus dated November 5, 2001, CDFG, Region 2 files; Unpublished data from Titus for 2002-2003.**

3. Water Temperature Information from Bailey Environmental, May to August 2003: In May 2003, Placer County contracted to add additional stations on Secret Ravine. Stations were added at Loomis Basin Park, AMPM Minimart near Rocklin Road, and at the Olympus Point development in Roseville behind the United Artists theatre complex. Figures 8 and 9 display all of the data to date. Data from the Olympus Point station is missing due to theft of the temperature sensor. All of the data for all of the stations has been delivered to the County in electronic format. Bailey Environmental has all data in its statistics package and can generate most any type of analysis on short notice. **Source: Bailey Environmental, unpublished data.**

Figure 4. Water temperature time series for Secret Ravine at Gilardi Road for the period July 30 through August 31, 2002. Temperatures are suitable for juvenile rearing.

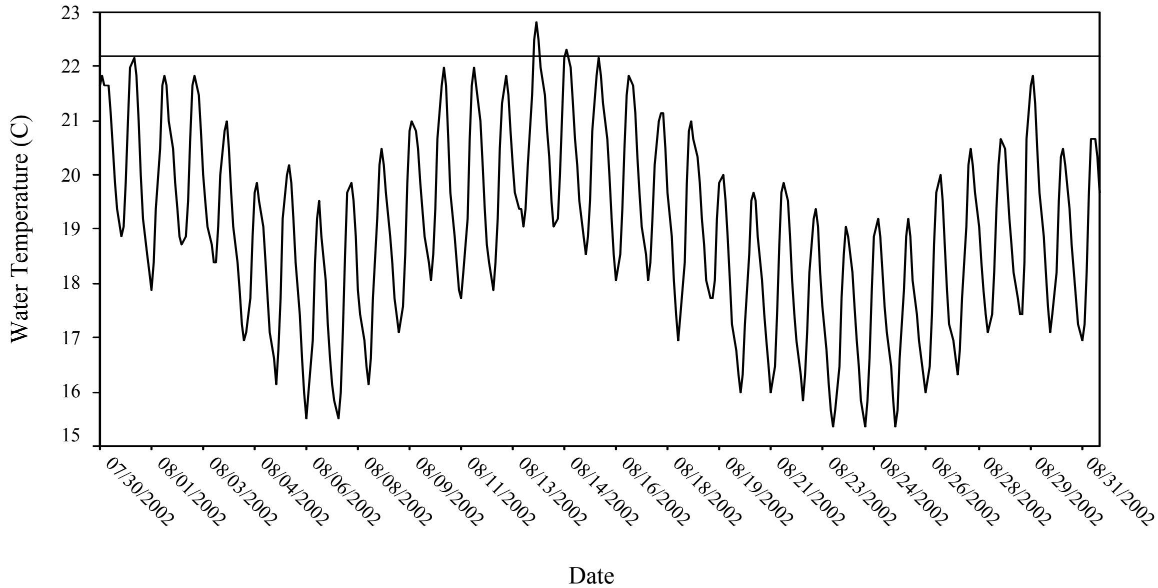


Figure 5. Water temperature time series for Secret Ravine at Gilardi Road for the period September 1 through December 31, 2002. Temperatures are suitable for juvenile rearing or adult spawning.

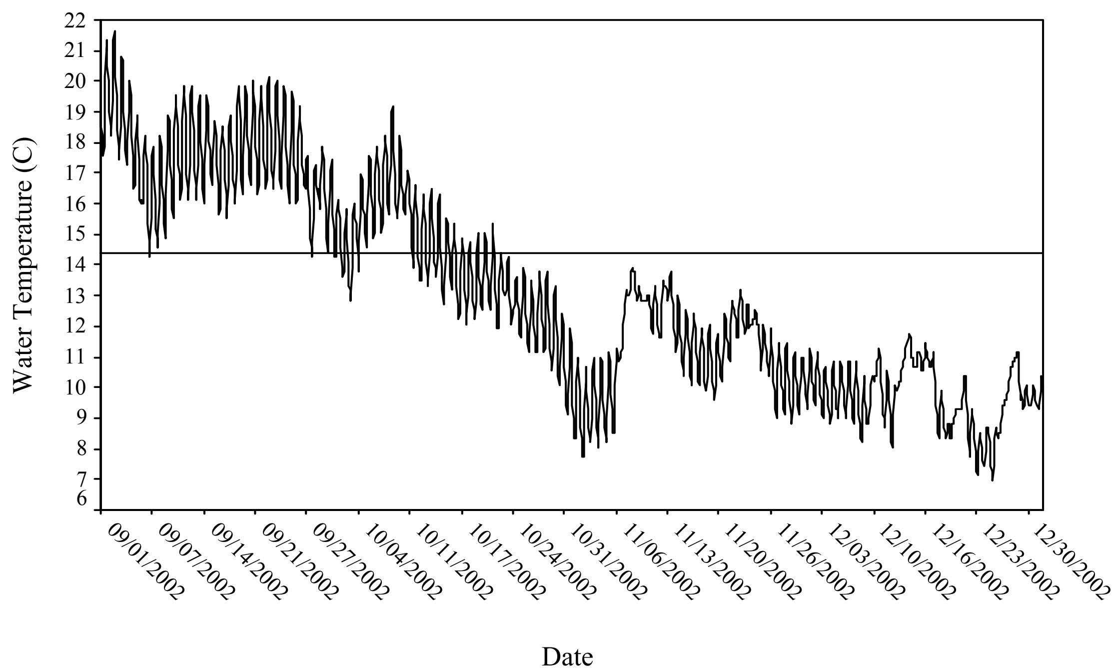


Figure 6. Water temperature time series for Secret Ravine at Gilardi Road for the period January1 through April 30, 2003. Temperatures are suitable for juvenile rearing or adult spawning.

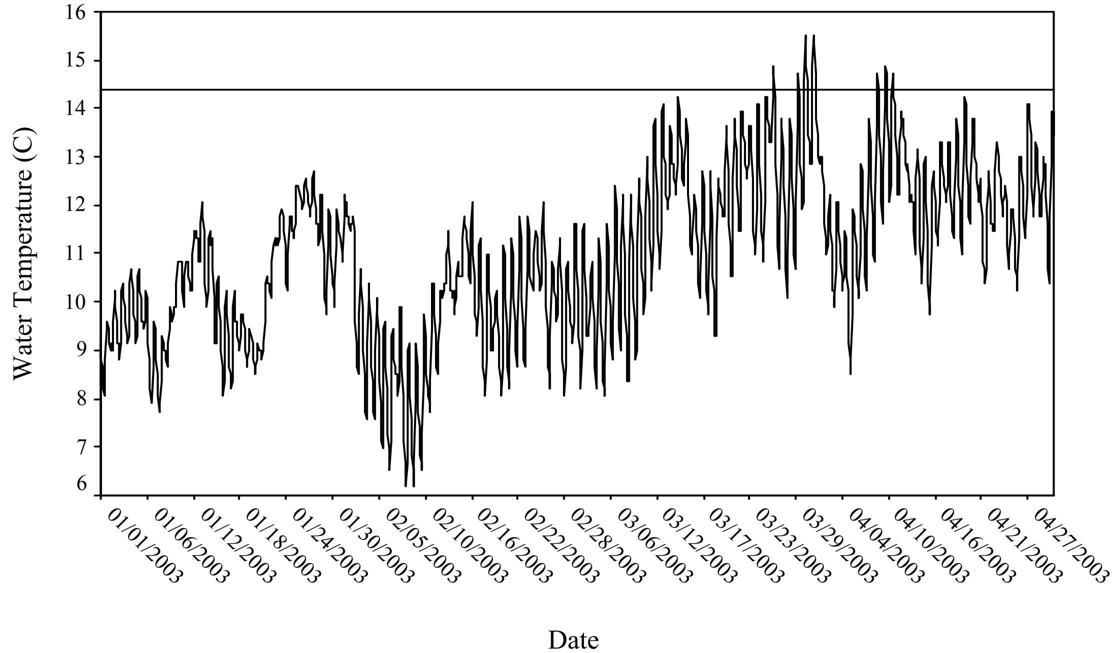


Figure 7. Water temperature time series for Secret Ravine at Gilardi Road for the period May 1 through August 31, 2003. Temperatures are suitable for juvenile rearing.

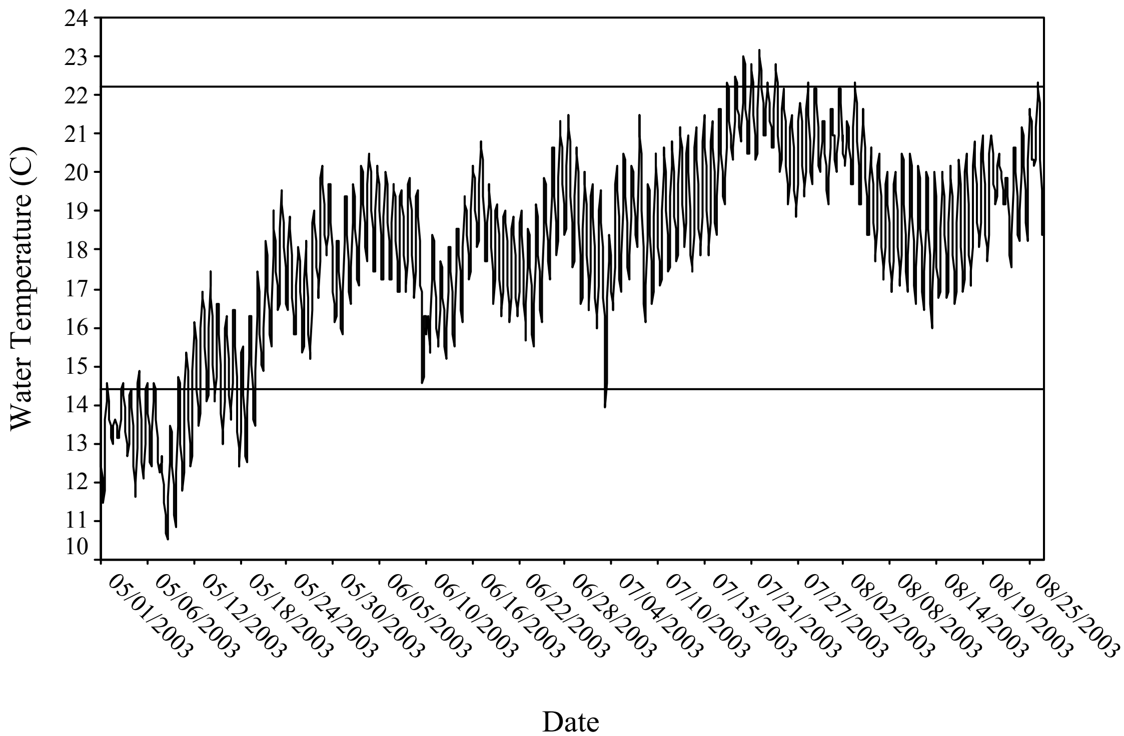


Figure 8. Water temperature time series for Secret Ravine at Loomis Basin Park for the period May 29 through August 5, 2003. Temperatures are suitable for juvenile rearing.

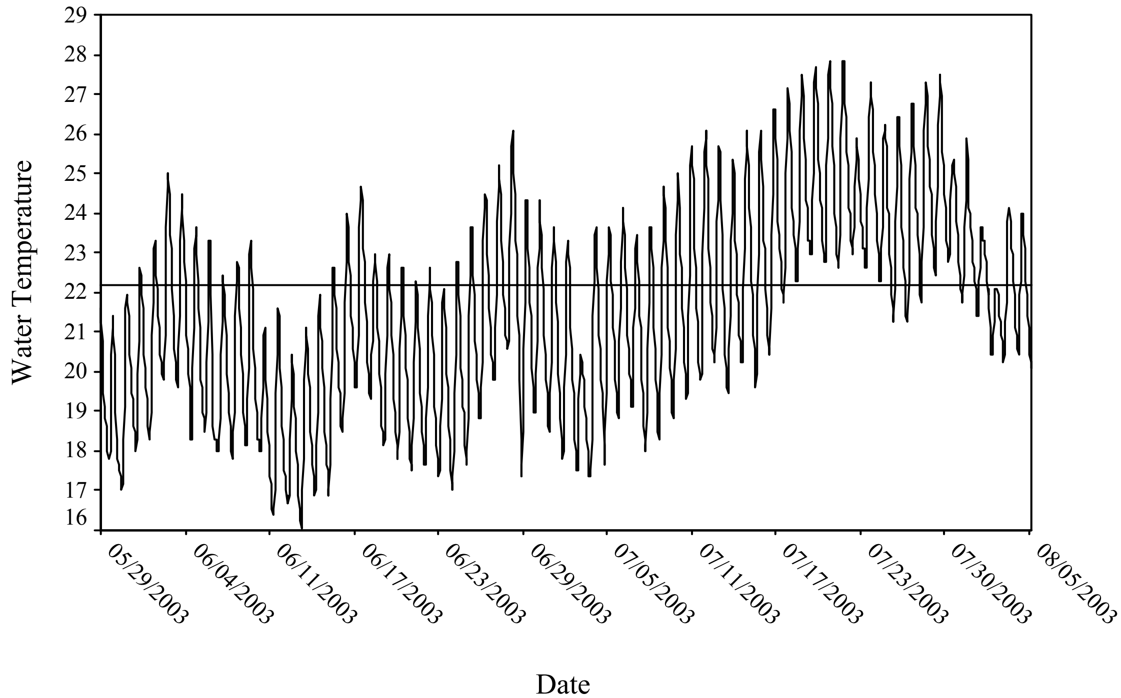
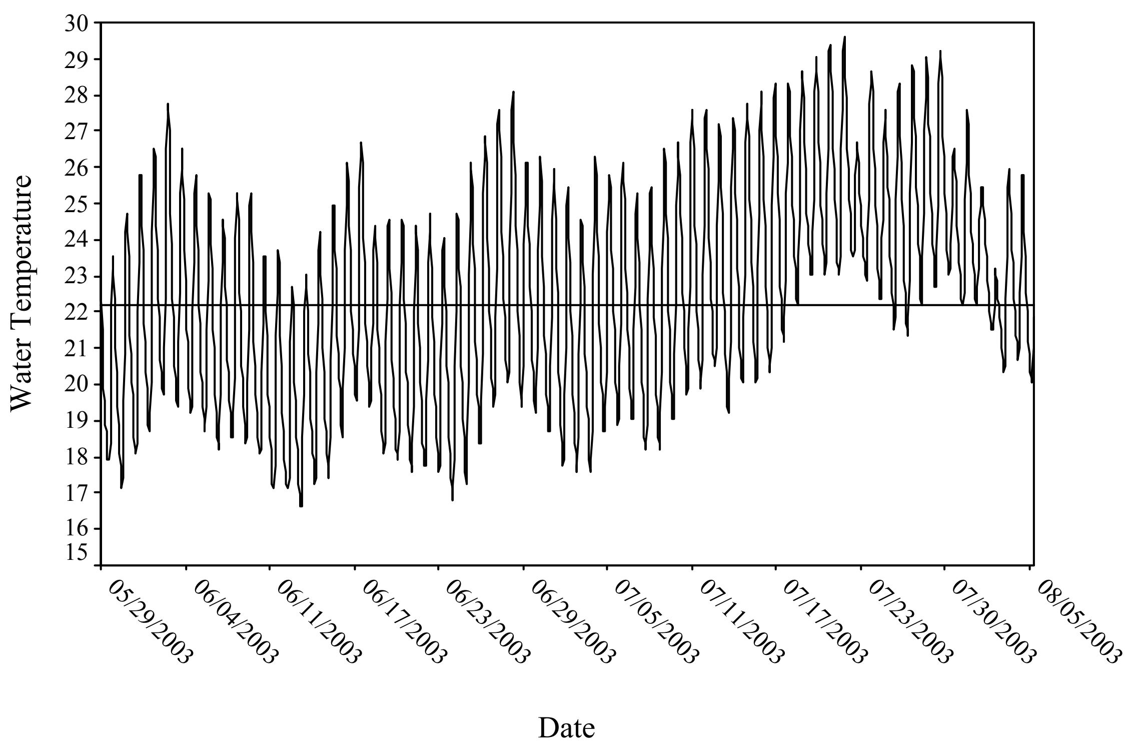


Figure 9. Water temperature time series for Secret Ravine at the AMPM Minimart near Rocklin Road for the period May 29 through August 5, 2003. Temperatures are suitable to marginal for juvenile rearing.



C. <u>Benthic Invertebrate Data</u>

1. Wayne C. Fields, 1999. Fields collected samples from six locations in Secret Ravine during September of 1999 (corresponding to specific habitat units identified in the physical habitat inventory conducted by Stacy Li and Fields in the spring of 1999). Fields' sampling locations and general characteristics of the riffle's quality is presented in Table 4 (All data is presented in Appendix Secret Ravine 1). Fields attempted to rate each riffle's habitat quality, based on visual observation, prior to conducting the sampling. Analysis of the data indicates that 5 of the 6 locations did not have significantly different benthic invertebrate species composition and population levels, even though the visual observations indicated otherwise. Habitat units 93 and 97 were dissimilar, but Fields indicates that off road vehicle traffic through the stream may have influenced the results. He also concludes that Secret Ravine's benthic invertebrate population characteristics are indicative of a stream suffering from higher water temperatures and organic pollution. **Source: The Benthic Macroinvertebrate Fauna of Secret Ravine Creek, Placer County, California by Wayne C. Fields, 1999.**

Table 4. Description of riffles sampled for benthic macroinvertebrates during September 1999 by Wayne Fields in Secret Ravine.

Habitat Unit	Location	Habitat Quality	Type of Riffle
3	Upstream of Miners Ravine	Good	Low Gradient
5	Upstream of Miners Ravine	Fair	Low Gradient
93	Meadow, West End of China Garden Rd.	Good	Low Gradient
97	Meadow, West End of China Garden Rd.	Poor	Low Gradient
251	Downstream of Dominguez Road	Fair	Low Gradient
253	Downstream of Dominguez Road	Good	Low Gradient
318	Behind Sierra College	Fair	Medium Gradient
322	Behind Sierra College	Excellent	Medium Gradient
492	Below Horseshoe Bar Road	Excellent	Medium Gradient
505	Above Horseshoe Bar Road	Fair	Medium Gradient
618	Loomis Basin Park	Fair	Low Gradient
629	Loomis Basin Park	Excellent	Low Gradient

Source: The Benthic Macroinvertebrate Fauna of Secret Ravine Creek, Placer County, California by Wayne C. Fields, 1999.

2. Dry Creek Conservancy. Members of the Dry Creek Conservancy conduct the sampling program for benthic macroinvertebrates. Sampling data from 2000 (at a single, unidentified site and a single sample from a site identified as "Secret Ravine Gravel Site") and two sampling sites in 2001 (Sierra College, not identified as the College or Blvd., and near the confluence with Miners Ravine) are presented in Appendix Secret Ravine 1. These data indicate a high percentage of pollution tolerant organisms, with almost no taxa associated with cleaner waters. These results are not unexpected given the urban nature of the stream and the amount of sediment deposited in the channel. **Source: Dry Creek Conservancy, unpublished data.**

D. Physical Habitat Data

Physical habitat data consists of a single detailed study and several partial evaluations for Secret Ravine:

1. 1963 and 1964 Spawning Gravel Survey by Eric Gerstung: Gerstung conducted spawning gravel surveys in Secret Ravine in conjunction with his chinook salmon spawning surveys in these two years. He described the stream as follows:

1. Water cool during the summer
2. Pools frequent and deep
3. Riffles short and consist of quartz gravel
4. Granite sand covers bottom of slow velocity sections
5. Spawning gravel capacity to support 1,000 adult spawners

Source: June 3, 1965 Memorandum, by Eric Gerstung, entitled "THE FISH AND WILDLIFE RESOURCES OF THE SECRET RAVINE CREEK AREA OF PLACER COUNTY AND RECOMMENDATION FOR THEIR PROTECTION"; CDFG, Region 2 files.

2. 1992-1993 Habitat Inventory by David Vanicek, Professor at California State University, Sacramento: The habitat inventory was limited to one reach. Vanicek describes this 2300 m reach as follows:

> "Reach SR: Reach runs from the confluence with Miners Ravine upstream 2300 m to the city limit. Description: Diversity of flatwater, riffles, and pools (including several 1st class pools); rubble and gravel comprise about 40% of substrate; several spawning sites; considerable canopy; good cover provide by logs, pools, and overhanging vegetation; possible barriers at low flow: old concrete dam near Miners Ravine confluence, and shallow riffle beneath [Roseville] Parkway Bridge; overall quality: 5."

Vanicek defines flatwater as the same as would be considered a glide in most other methodologies. In his scheme, a "1st class pool" is large and deep with more than 30% of the stream bottom obscured, etc., or a maximum depth of > 1.5m. **Source: Fisheries Habitat Evaluation Dry Creek, Antelope Creek, Secret Ravine, and Miners Ravine (Task I); Prepared for EIP Associates by C. David Vanicek, CSUS Hornet Foundation, August 1993, Copy from CDFG files, Region 2.**

3. 1997 Spawning Gravel Survey by John Nelson, Department of Fish and Game: Nelson surveyed the stream from the confluence with Miners Ravine to approximately 1.5 miles upstream in 1997. He visually estimated the amount of spawning gravel 2-13 cm in diameter (3/4–5") and percentage of embeddedness. His conclusion was that embeddedness was >20% ad that at least 600 fish could be accommodated. He also recommended spawning substrate restoration because of the amount of sand in the spawning riffles. **Source: 9/27/97 Memorandum from John Nelson, CDFG, Region 2 files.**

4. 1999 Steam Habitat Assessment by Stacy Li and Wayne Fields for the Dry Creek Conservancy: This survey was completed between February and June 1999 and covered the stream length from the confluence with Miners Ravine upstream to Rock Springs Road (10.0 miles). Measurements for a variety of variable were recorded (Table 5) and analysis of 24 variables (21 by cumulative percentage and 3 by percentage only) is included in the report. Seven habitat types were identified with four (Table 6) dominating the habitat typing. The dominant substrate recorded was sand and covered 70.71% of the stream bottom in the length of stream surveyed. **Source: Existing Conditions Report entitled *Assessments of Stream Habitat in Secret Ravine, Placer County, California, Spring, 1999,* by Stacy Li and Wayne Fields, prepared for the Dry Creek Conservancy.**

Table 5. List of parameters recorded in the Li and Fields habitat assessment for Secret Ravine in the spring of 1999.

Parameters Recorded	Parameters Recorded	Parameters Recorded
Date Sampled	Rearing Habitat Quality Ranking	Quality of Spawning Gravel Ranking
Habitat Unit Number	Rearing Habitat Quality Constraints Ranking	Quality of Spawning Gravel Constraints Ranking
Habitat Type	Instream Cover	Cover (along bank)
Pool Type	Area of Benthos Habitat (gravel riffle) (sq. ft.)	Maximum Pool Depth (ft)
Cumulative Length to Habitat Unit Downstream End (ft)	Quality of Benthos Habitat Ranking	Water Depth at Pool Tail Crest (ft)
Cumulative Length to Habitat Unit Upstream End (ft)	Substrate Texture	Dominant Substrate Ranking
Mean Channel Width (ft)	Gravel Embeddedness	Channel Cross Section Symmetry
Surface Water Velocity Rating	Depth of Embeddedness	Channel Shape
Typical (mode) Water Depth (ft.)	Number Shear	Parallel Flow
Water Surface Turbulence Rating		

Source: Existing Conditions Report entitled *Assessments of Stream Habitat in Secret Ravine, Placer County, California, Spring, 1999,* by Stacy Li and Wayne Fields, prepared for the Dry Creek Conservancy.

Table 6. Distribution of major habitat types by cumulative frequency, cumulative length, and cumulative area in Secret Ravine during the spring of 1999. Other habitat types comprised less than 2% each.

Habitat Type	Frequency (%)	Rank	Length (%)	Rank	Area (%)	Rank
Run	42.9	1	52.89	1	49.94	1
Glide	13.9	4	17.80	2	20.77	2
Pool	17.14	3	16.00	3	18.10	3
Riffle	20.23	2	10.98	4	9.23	4

Source: Existing Conditions Report entitled *Assessments of Stream Habitat in Secret Ravine, Placer County, California, Spring, 1999,* by Stacy Li and Wayne Fields, prepared for the Dry Creek Conservancy.

5. 2002 Stream Habitat Assessment for Placer County by ECORP Consulting, Inc.: ECORP completed a habitat assessment on approximately 5.2 miles of Secret Ravine between July 25th and October 26th 2002, beginning at the confluence with Miners Ravine and working upstream. They recorded habitat types as either pool, run, or riffle. A list of variables recorded is presented in Table 7. No analysis is presented and all I have available is the electronic data files with some preliminary summary information. **Source: Unpublished Habitat Assessment Data Files Collected by ECORP Consulting and forwarded by Barbara Washburn, California Environmental Protection Agency.**

Table 7. Summary of habitat parameters collected by ECORP during their 2002 habitat assessment of Secret Ravine.

Parameters Recorded	Parameters Recorded	Parameters Recorded
Date Sampled	Left Mid-Channel Depth	Percent Canopy Cover
Habitat Unit Number	Center Channel Depth	Area of Canopy Cover
Habitat Type	Right Mid-Channel Depth	Percent Instream Cover
Length of Habitat Unit (ft.)	Maximum Depth	Area of Instream Cover
Mean Channel Width (ft.)	Percentage Substrate Composition (9 categories)	Type of Instream Cover [Presence/Absence (9 categories)]
Flood Prone Width	Mean Depth	

Source: Unpublished Habitat Assessment Data Files Collected by ECORP Consulting and forwarded by Barbara Washburn, California Environmental Protection Agency.

6. 2003 Placer County Stream Videography Project: On March 12, 2003 Secret Ravine was videotaped by air. While the footage is informative, the amount of riparian canopy limits the effectiveness of this source, particularly given the detailed information contained in the 1999 habitat assessment by Stacy Li and Wayne Fields for the Dry Creek Conservancy and the 2002 partial habitat assessment by ECORP Consulting, Inc. **Source: Placer County Stream Videography Project.**

E. Fishery Resource Data

1. Documented Fish Species Present in the Stream

Fall-run chinook salmon (native)
Fall-run chinook salmon (introduced)
Steelhead/rainbow trout
Bluegill
Green sunfish
Brown bullhead
Common carp
Fathead minnow
Black bullhead
Pacific lamprey
Largemouth bass
Sacramento sucker
Sacramento pikeminnow (formerly known as Sacramento squawfish)
Spotted bass
Smallmouth bass
Redear sunfish
Warmouth
White crappie
White catfish
Roach
Goldfish
Hitch
Hardhead
Golden shiner

Source: California Department of Fish and Game, Region 2 files; DEIR Northeast Roseville Specific Plan, City of Roseville, October 1986; Placer County Flood Control and Water Conservation District, FPEIR Dry Creek Water Flood Control Program, October 1994; November 5, 2001 and February 5, 2003 Memoranda from CDFG Biologist Rob Titus, CDFG, Region 2 files; May 25, 1965 Memorandum from CDFG Biologist Eric Gerstung, CDFG, Region 2 files; June 3, 1965 Memorandum, by Eric Gerstung, entitled "THE FISH AND WILDLIFE RESOURCES OF THE SECRET RAVINE CREEK AREA OF PLACER COUNTY AND RECOMMENDATION FOR THEIR PROTECTION"; CDFG, Region 2 files.

2. Fish Stocking Records

Only five records (Table 5) of fish stocking were found in Department of Fish and Game files.
Source: CDFG, Region 2 files; CDFG, Region 2 files.

Table 5. Summary of fish stocking records for Secret Ravine.

Species	Origin	Date	Size (No./lb)	Mean Length*	Number Stocked	Location
Spring chinook salmon	Feather R. FH	2/20/85				None given
Fall-run chinook salmon	Feather R. FH	1/31/86	480	48	24,000	Loomis Basin Park
Fall-run chinook salmon	Feather R. FH	1/27/87	800	41	100,000	Loomis Basin Park
Fall-run	Feather R. FH	1/12/89	1,072	37	100,678	Sierra College Blvd.

chinook salmon						
Fall-run chinook salmon	Coleman/Nimbus	1/31/91	1,000	38	28,000	Sierra College
Fall-run chinook	Nimbus FH	3/2/93	1,230	36	51,660	Sierra College Blvd.

Source: CDFG, Region 2 files; CDFG, Region 2 files.

3. Adult Spawning Timing, Distribution, and Population Estimates

- **1963 Fall-run Chinook Salmon Spawning Survey by Eric Gerstung:** Gerstung conducted a salmon spawning survey in the fall of 1963. He described the physical habitat conditions (outlined above) and also observed that salmon spawned upstream to Rock Springs Road in Penryn (approximately 8 miles total distance). He indicated that spawning occurs in November in December, with juveniles emigrating to the ocean in April and May. He notes that steelhead spend 1-2 years in the stream. He estimated the 1963 fall-run size at 300 fish. **Source: June 3, 1965 Memorandum, by Eric Gerstung, entitled "THE FISH AND WILDLIFE RESOURCES OF THE SECRET RAVINE CREEK AREA OF PLACER COUNTY AND RECOMMENDATION FOR THEIR PROTECTION"; CDFG, Region 2 files; CDFG, Region 2 files.**

- **1964 Fall-run Chinook Salmon Spawning Survey by Eric Gerstung:** Gerstung conducted a survey of 2,500 ft. of stream (800 ft. at Rocklin Road Bridge, 900 ft. at Himes Road Bridge [Sierra College Blvd.] and 800 ft. at Taylor Road) on 11/23/64. Figure 10 shows the sections surveyed. He reported 38 carcasses and 4 live fish at Rocklin Road, 11 carcasses and 6 live fish at Himes [Sierra College Blvd.], and 13 carcasses and 4 live fish at Taylor Road. He estimated the run size to be 600+ fish and indicated that the run size was much larger than 1963 (estimated at 300 fish). Water clarity was reported as murky and flow estimated at 15 cfs. **Source: May 25, 1965 memorandum in CDFG, Region 2 files.**

- **1966 Fall-run Chinook Salmon Spawning Survey by Dan Gralian: Gralian** conducted a fall-run chinook salmon spawning survey on December 11, 1966. He counted fish in six locations (Table 6). His report states: "On a salmon count on Secret Ravine, between Penryn Rode [Road] and the Saw Mill, I saw only 4 "creamers" [carcasses] and one live salmon." [This location is obscure because the only sawmill along Secret Ravine is near Dominguez Road in Rocklin. However, the sequence of the observations (apparently) suggests that the "Saw Mill" location was near the confluence with Miners Ravine or downstream on Dry Creek mainstem. The other confounding factor is that one location is recorded as "Taylor Road" which I interpret to mean where Taylor Road comes near the confluence of Secret and Miners ravines.] The report continues: "The creek was covered with blackberry bushes along both sides of the bank so it was very difficult to see the stream. For this reason I very likely missed a great majority of the salmon. I talked to many of the residents along the creek and they said the salmon had not really come up yet. They said that for some reason the salmon were late and they had seen very few." **Source: Handwritten memorandum dated 12/11/66 by Dan Gralian; CDFG Region 2 files.**

Figure 10. Location of 1964 salmon spawning surveys conducted by Eric Gerstung. This figure shows that he found fish spawning in Secret Ravine.

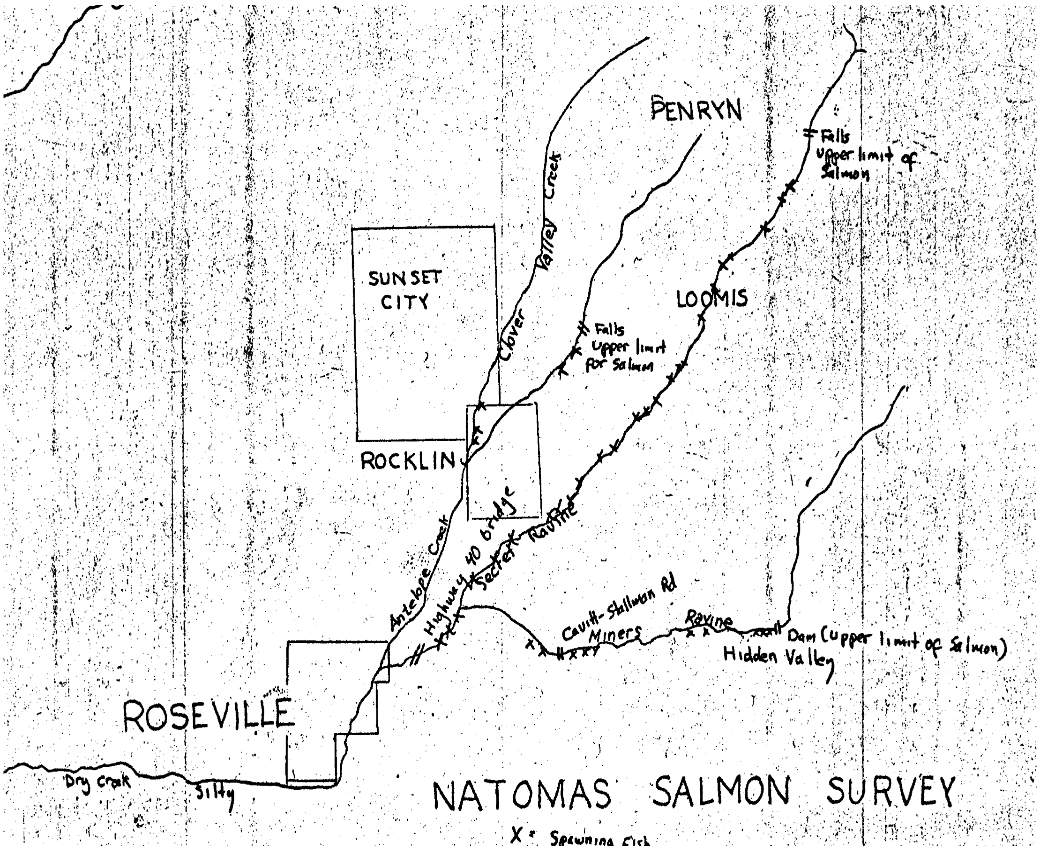


Table 6. Summary of fall-run chinook salmon spawning surveys completed on Secret Ravine on 12/11/1966.

Location	Distance Surveyed Upstream	Distance Surveyed Downstream	Results
Penryn Rd.	0.75 miles	To King Road	1 creamer downstream
Loomis Rd. [Horseshoe Bar]	To King Road	0.5 miles	1 creamer upstream; 1 live downstream
Himes Rd. [Sierra College Blvd.]	0.5 miles	0.5 miles	1 creamer downstream
Rocklin Rd.	0.5 miles	0.5 miles	No salmon; good spawning beds downstream
Taylor Rd.	0.75 miles	0.25 miles	No salmon
Saw Mill	0.25 miles	0.5 miles	1 creamer downstream

Source: Handwritten memorandum dated 12/11/66 by Dan Gralian; CDFG Region 2 files.

- **11/8/1968 Warden's Report:** A warden's report [for Friday, November 8] included observation of 107 salmon in Secret Ravine. [The warden's report did not indicate a year, but specified November 8th and Friday. I checked with the warden captain from CDFG Region 2 and he indicated that the form used in the report was from the mid-1960's to 1970's. A check of the universal calendar indicated that the only Friday November 8th during the period when the form was used occurred in 1968. I have thus assumed 1968 for this report.] **Source: Copy of Warden's Report in CDFG; Region 2 files.**

- **11/26/68 Fall-run Chinook Salmon Spawning Survey from Rocklin Road upstream to Brace Road:** This survey reported the following results:

  1. Rocklin Rd. to Sierra College Blvd. – 2 live fish; 1 carcass
  2. 100 yards upstream of Sierra College Blvd. – 1 live fish; 3 carcasses
  3. 2 live fish spawning 100 yards downstream of Brace Rd.
  4. One live fish below Brace Rd.; in the top 1/3 of the section.

  Flow was estimated at 8 cfs and 30-40% of the stream length was no accessible because of the berry vines.
  Source: Memorandum in CDFG; Region 2 files.

- **11/29/68 Fall-run Chinook Salmon Spawning Survey from Brace Road upstream to Rock Springs Road:** This survey reported the following results:

  5. Rock Springs Rd. downstream to ponds – 1 live fish; 1 carcass
  6. Rock Springs Rd. upstream 0.5 miles – 1 live fish; [two kids reported seeing 5 fish during the run]
  7. Penryn Rd. upstream 200 yards - 2 live fish [resident report seeing 9 fish during the run].

  Source: Memorandum in CDFG; Region 2 files.

- **December 6, 1985 Spawning Survey:** Secret Ravine was surveyed for fall-run chinook salmon on 12/6/85. The stream was surveyed from the confluence with Miners Ravine to approximately 0.5 miles upstream. No live fish or redds were seen, but two female carcasses (59 and 78 cm) and two male carcasses (91 and 99 cm) were seen and measured. Two skeletons were also seen. Flow was estimated at 20 cfs and visibility was 1-2 ft. **Source: 12/19/85 Memorandum from CDFG Biologist Phil Hanson, CDFG; Region 2 files.**

- **Mid-December 1991 CDFG Warden Report:** Warden reported 4 adult chinook salmon in Secret Ravine "just above Roseville". **Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.**

- **1992-1993 Habitat Inventory by David Vanicek, Professor at California State University, Sacramento:** Vanicek reports conducting surveys along Secret Ravine in December 1992 and January 1993. One live fish was seen on December 3 in a pool about 50 meters above the [Roseville] Parkway Bridge. Two carcasses were observed on

December 3 about 300-400 meters above the Parkway Bridge and one carcass was observed on January 4 about 100 meters above the Parkway Bridge. Vanicek also reports a personal communication (December 10) with John Edgar, former Placer County Fish and Game Commissioner who reported that he had observed no adult salmon this year [1992], but that he had seen 72 in the watershed last year, mostly in Secret Ravine. **Source: Fisheries Habitat Evaluation Dry Creek, Antelope Creek, Secret Ravine, and Miners Ravine (Task I); Prepared for EIP Associates by C. David Vanicek, CSUS Hornet Foundation, August 1993, Copy from CDFG files, Region 2.**

- **1997 Spawning Gravel Survey by John Nelson, Department of Fish and Game:** Nelson surveyed the stream from the confluence with Secret Ravine to approximately 1.5 miles upstream in 1997. In this memorandum Nelson notes that the historical spawning run size in the Dry Creek Watershed is more than 1,000 fish with more than 60% occurring in Secret Ravine and more than 10% of the run occurring in Miners Ravine. **Source: 9/27/97 Memorandum from John Nelson, CDFG, Region 2 files.**

- **Summary of Dry Creek Conservancy Fall-run Chinook Salmon Surveys in Secret Ravine:** Dry Creek Conservancy members have been conducting foot surveys during the fall and early winter since 1997. Five reaches are described:

    1. Secret Ravine 1 (SR1): Secret Ravine from confluence with Miners Ravine to Roseville Parkway Bridge (approximately 1,400 ft.).
    2. Secret Ravine 2 (SR2): Secret Ravine from Roseville Parkway Bridge to:
1997: Sandbar island below Sutter Hospital (approximately ½ mile).
1998: Old diversion abutments (approximately ¾ mile.)
1999-2000: South end of China Garden Road (approximately 1 mile)
    3. Secret Ravine 3 (SR3): Secret Ravine from China Garden Road to Rocklin Road.
    4. Secret Ravine 4 (SR4): Secret Ravine from Rocklin Road to Sierra College footbridge (approximately 5,000 ft.).
    5. Secret Ravine 5 (SR5): Secret Ravine in Loomis Basin Park

Surveys usually begin about November 1 and continue until late December. Surveys are conducted periodically (varying periods) on five reaches (not all reaches are necessarily surveyed on the same day or within the same week, varying from year to year). Figures 11-16 displays the number of live fish and carcasses counted in all reaches combined for a single date (theoretically these totals could reflect from one to five reaches). In order to more fully assess spawning run timing and geographic distribution, a reach-by-reach analysis and evaluation is needed. Surveys have not been systematic or comprehensive and therefore, make assessing actual population numbers impossible. **Source: Dry Creek Conservancy; unpublished data; Placer County Flood Control and Water Conservation District and Sacramento County Water Agency, Final Report: Dry Creek Watershed Flood Control Plan, April 1992, Table 5-1, some reach lengths only.**

Figure 11. 1997 fall-run chinook salmon spawning surveys in Secret Ravine.

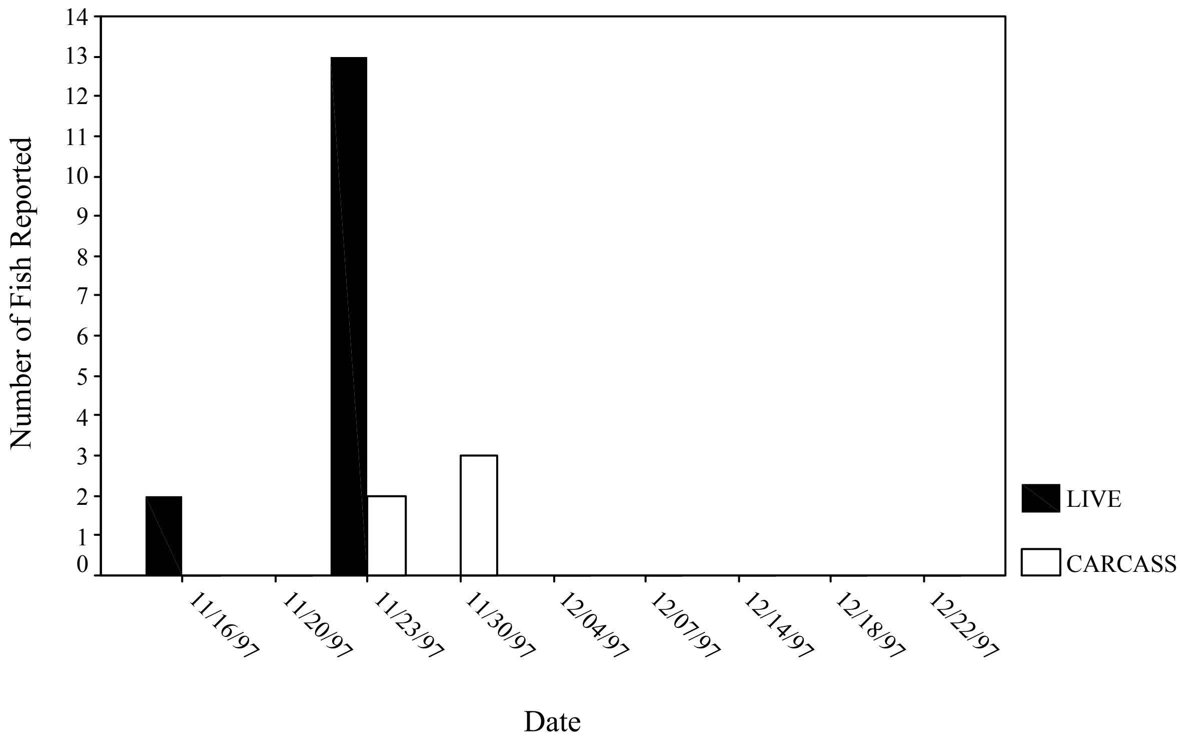


Figure 12. 1998 fall-run chinook salmon spawning surveys in Secret Ravine.

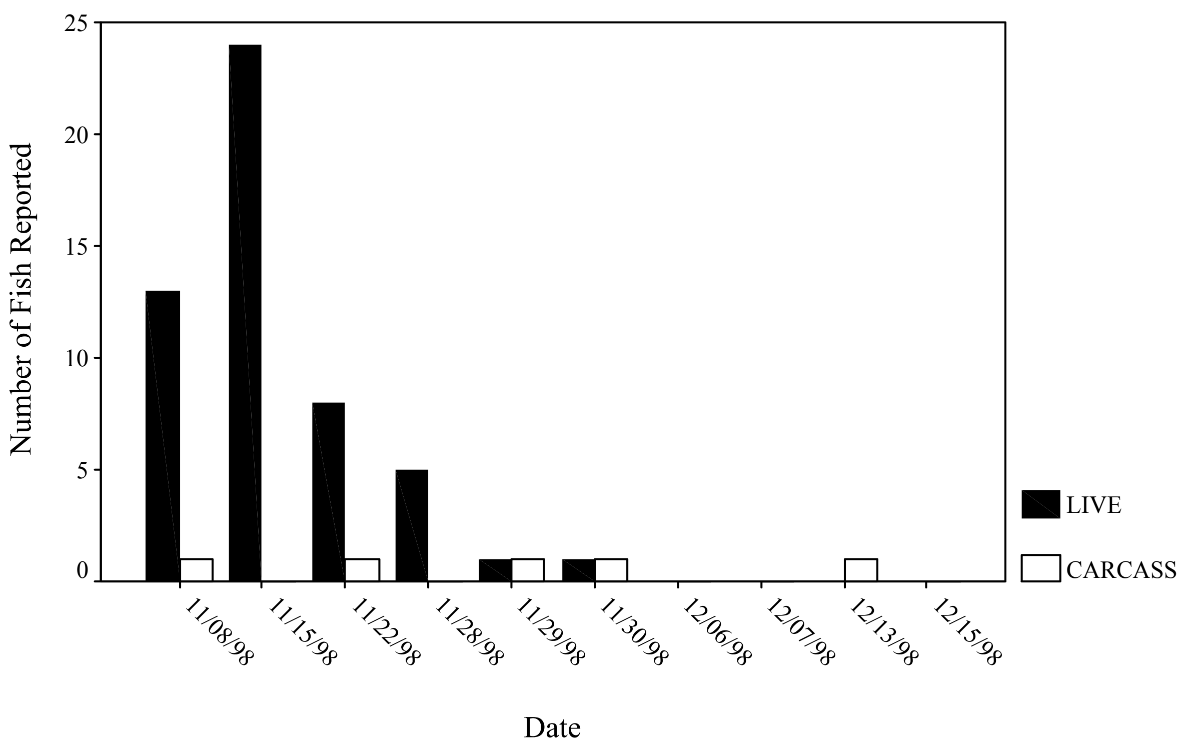


Figure 13. 1999 fall-run chinook salmon spawning surveys in Secret Ravine.

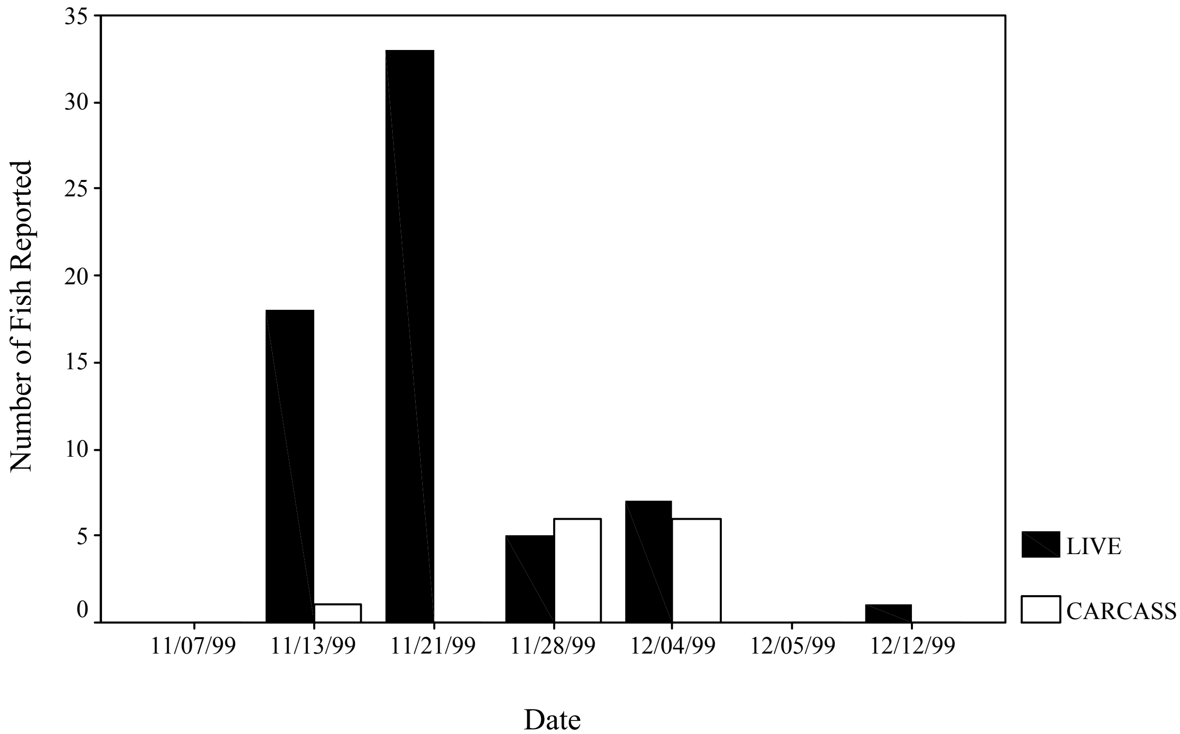


Figure 14. 2000 fall-run chinook salmon spawning surveys in Secret Ravine.

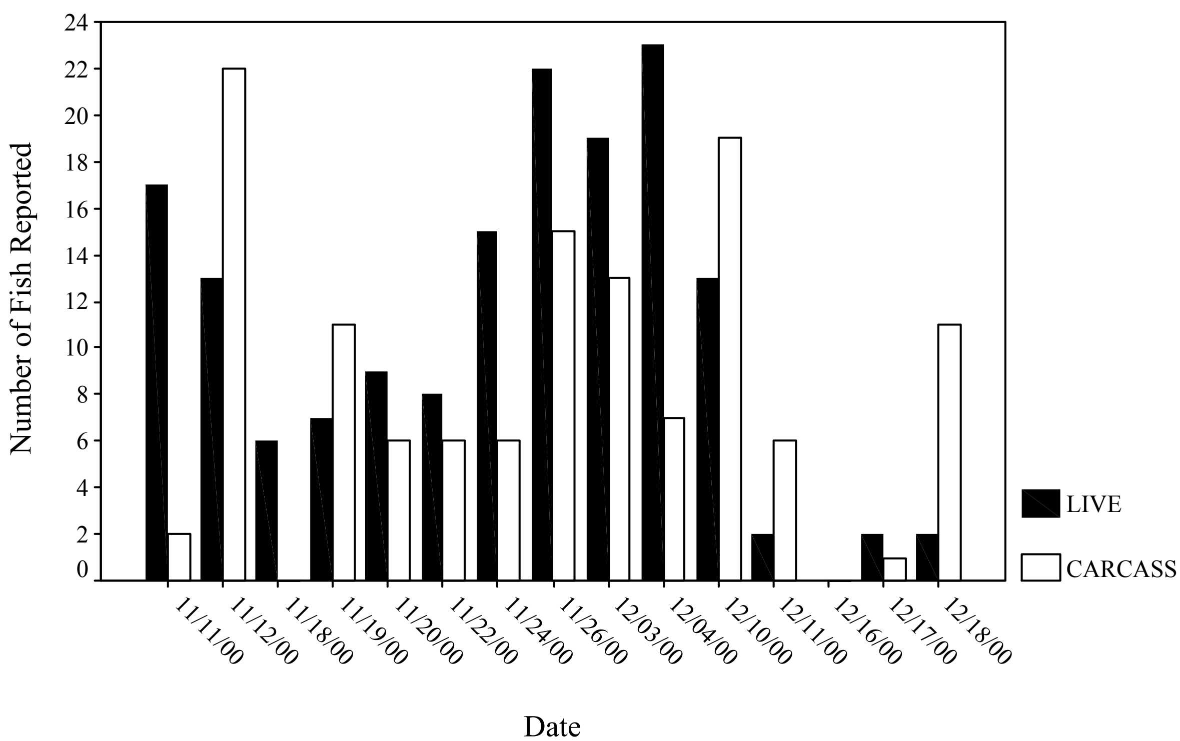


Figure 15. 2001 fall-run chinook salmon spawning surveys in Secret Ravine.

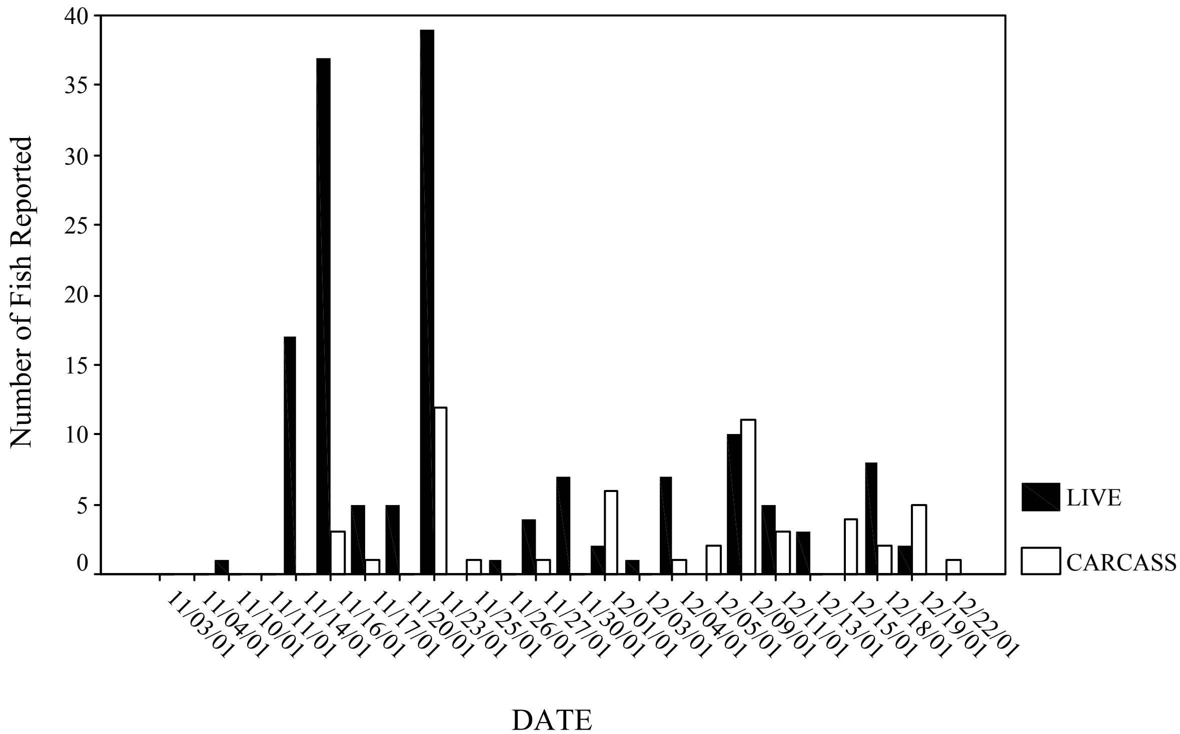
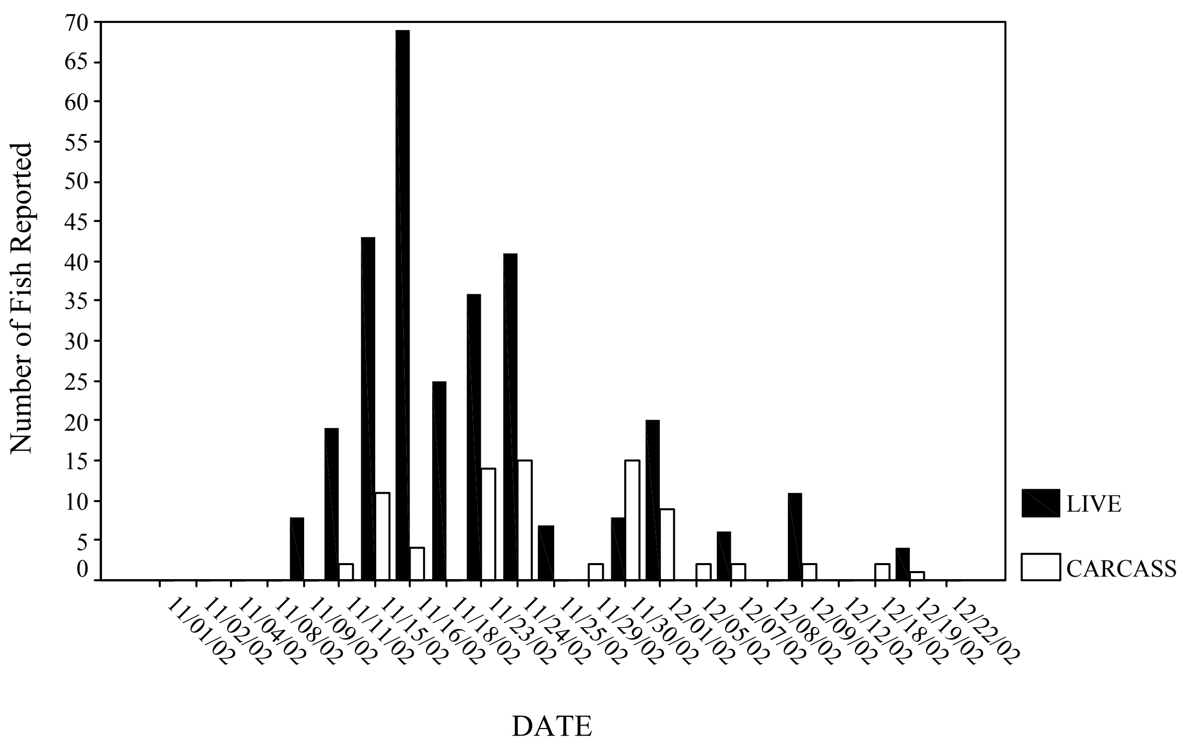


Figure 16. 2002 fall-run chinook salmon spawning surveys in Secret Ravine.



4. Juvenile Distribution and Sampling Data

- **Spring 1965 Fall-run Chinook Salmon Juvenile Emigration Survey by Eric Gerstung:** Gerstung began trapping for downstream migrant fall-run chinook juveniles in Secret Ravine at a site about 50 yards upstream of Sierra College Blvd. [cited in the original memorandum as "Himes Bridge", referring to the bridge on Himes Rd., which connected Taylor Rd. and Rocklin Rd. prior to the construction and renaming to Sierra College Blvd.] on February 16, 1965 and continued through March 4, 1965. Sampling was with a "riffle" trap or perforated plate trap. The trap fished a total of 352 ¾ hours and captured 1,338 juvenile chinook salmon alive, with 187 dead recorded. Gerstung noted: "thousands of salmon fry observed in Secret Ravine during April". Catch composition is noted as: crayfish, bullhead, green sunfish, hitch, rainbow trout, lamprey, and squawfish. Water temperatures were reported as ranging from 45-53 ^{O}F during this time period. **Source: May 25, 1965 memorandum in CDFG, Region 2 files; handwritten draft of May 25, 1965 memo, and other handwritten notes.**

- **August 8, 1966 One-time Electrofishing Event:** CDFG staff conducted a one-time electrofishing survey at Penryn [I assume Penryn Road crossing] on 8/8/66. Sampling occurred over a 100-foot reach of stream with catch consisting of ammocetes (juvenile lamprey) and three steelhead juveniles (4.3", 3.9", and 3.3"). **Source: Memorandum in CDFG, Region 2 files.**

- **August 2, 1967 One-time Electrofishing Event:** CDFG staff conducted a one-time electrofishing survey below "Rustic Hills" [a subdivision near the west end of China Garden Road in Rocklin] on August 2, 1967. Catch is reported as three rainbow trout (2.3", 2.4", and 3.0") and 14 "roughfish" [historically consisting of non-game native and non-native species]. Water flow was estimated as 8 cfs, water temperature was 74 ^{O}F, stream width was 25 ft., pool area was estimated as 4, 725 sq. ft., riffle area as 400 sq. ft., 205 ft. of stream length electrofished, pool depth 1-2 ft., and no spawning gravel noted. **Source: Memorandum in CDFG, Region 2 files; copy of data survey form.**

- **March 30, 1972 One-time Electrofishing Event:** CDFG staff conducted a one-time electrofishing survey "west of I-80" on March 30, 1972. A 100-foot section was sampled with catch reported as two rainbow trout adults, one rainbow trout fingerling (juvenile), and 8 chinook salmon fingerlings (juveniles). Water flow was estimated as "high". **Source: Memorandum in CDFG, Region 2 files.**

- **April 5, 1983 Seining Efforts at Brace Road and Rocklin Road:** CDFG staff conducted a one-time seining effort at two locations on Secret Ravine, with no estimate of area or distance of stream channel sampled. Catch and conditions are reported as:

    1. Brace Road – 2 squawfish fry, 2 lamprey, and 1 sucker fry; water temperature was 54 ^{O}F at 1030 hours.
    2. Rocklin Road – 12 chinook salmon juveniles (50, 50, 52, 59, 60, 61, 62, 68, 69, 69, 73, and 78 mm); water temperature was 54 ^{O}F at 1110 hours. **Source: Memorandum in CDFG, Region 2 files.**

- **1984 Seining and Electrofishing for Native Brood Year 1983 Fall-run Chinook Salmon:** Water temperatures for this sampling effort are reported above. Fish sampling results are presented in Table 7. **Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.**

Table 7. Sampling results of a juvenile chinook salmon seining and electrofishing at two locations in Secret Ravine during the spring of 1984.

Date	Effort	No. Chinook	Length Mode (mm)	Length Range (mm)	Other Fish Species	Location
2/29/84	2 seine hauls	5	40	39-43	2- hardhead	Rocklin Rd.
2/29/84	2 seine hauls	7	38	37-38	2- squawfish*	Brace Rd.
3/6/84	1 seine haul	1		78	1- catfish, 1- squawfish	Rocklin Rd
4/2/84	1 seine haul	31	69	41-73	---	Rocklin Rd
4/2/84	1 seine haul	8	37	37-48	1- squawfish	Brace Rd.
4/10/84	2 seine hauls + 100 ft. Electrofish.	23	---	---	---	Rocklin Rd
4/10/84	Electrofish. No length	5	---	---	---	Brace Rd
5/2/84	2 seine hauls	34	73, 77, 78	55-86	2- rainbow trout; 34- squawfish	Rocklin Rd
5/2/84	1 seine haul	2	---	52-88	1- rainbow trout; 1- squawfish	Brace Rd
5/24/84	2 seine hauls	2	78	78	4- squawfish; 8 sucker fry	Rocklin Rd

***** Sacramento squawfish are now known as Sacramento pikeminnow.
Source: Unsigned, unidentifiable author note in CDFG, Region 2 files.

- **March 1988 One-time Electrofishing Event:** Jones and Stokes Associates conducted a one-time electrofishing event at an unknown location on Secret Ravine. They sampled a 300-meter reach were electrofished for a total of 1 hour. Flows were characterized as "high". Catch composition is presented in Table 8. **Source: FEIR Dry Creek Watershed Flood Control Plan, October 1994, Table 6-2.**

Table 8. Catch composition from a one-time sampling effort on Secret Ravine during March 1988.

Species	Size Range (mm)	Number Captured
Sacramento pikeminnow (formerly squawfish)	70-370	8
Bluegill	110-145	5
Sacramento sucker	85-450	4
Largemouth bass	80-120	3
Green sunfish	120-190	2
Brown bullhead	120	1

Source: FEIR Dry Creek Watershed Flood Control Plan, October 1994, Table 6-2.

- **1998-2000 Sampling in Secret Ravine by Rob Titus, California Department of Fish and Game:** Titus' sampling consisted of electrofishing to determine distribution of rearing juvenile chinook salmon and steelhead and rotary screw trapping [trap located just downstream of the confluence with Miners Ravine] to determine emigration timing. Sections of Secret Ravine, from the confluence with Miners Ravine upstream to Gilardi Road, near Penryn, were electrofished between November 5, 1998 and June 8, 1999. The rotary screw trap was placed about 100 m downstream of the confluence with Secret Ravine and fished from November 6, 1998 through June 2, 1999 and from January 9, 2000 though June 8, 2000.

  Electrofishing captured juvenile steelhead from Brace Road upstream to Gilardi Road crossing and at four intermediate sites (Loomis Basin Park, L.D.S. Recreation Park upstream from Penryn Road crossing, and at one site on each of two forks of the upper creek accessed from Rock Springs Road. Juvenile steelhead were captured (n=58) and ranged in length from 21 to 310 mm FL and averaged 117 mm. These data indicate the presence of young-of-the-year steelhead as well as rearing yearling and older steelhead. Juvenile steelhead were not captured in the sampling sections between the confluence with Miners Ravine and Sierra College Blvd. No sampling occurred between Sierra College Blvd. and Brace Road. Juvenile chinook salmon were captured in each of the sampling sites downstream from Sierra College Blvd. Captures in the rotary screw trap included three steelhead smolts (177-212 mm FL) between March 14th and April 7, 1999 and 10 smolts (160-238 mm FL) from March 3, 2000 through April 28, 2000. Chinook salmon juvenile catches totaled 4,588 in 1999 and 401 in 2000.

  Titus, in the February 5, 2003 memorandum (Tables 9, 10, and 11), provides more detailed information regarding his sampling efforts. Notice juvenile steelhead were not found in the fall of 1998 or 2000 at Loomis Basin Park (Table 11), but were found in the Park during the spring of 1999 (Table 10). **Source: Memoranda from CDFG Biologist Rob Titus dated November 5, 2001 and February 5, 2003, CDFG, Region 2 files.**

Table 9. Temporal distribution of chinook salmon and steelhead catches in the rotary screw trap.

Month	1999 Chinook Salmon Catch	1999 Steelhead Catch	2000 Chinook Salmon Catch	2000 Steelhead Catch
January	0	0	5	0
February	658	0	103	0
March	1038	1	52	8
April	1375	2	57	2
May	1513	0	184	0
June	4	0	0	0
Total	4588	3	401	10

Table 10. Spatial and temporal distribution (+ = present; - = absent) of juvenile chinook salmon and steelhead in Secret Ravine during spring 1999 at various sampling locations.

Location	Sampling Date	Chinook	Steelhead
Upstream at mouth of stream	3/30/99	+	--
Downstream of East Roseville Parkway crossing	3/31/99	+	--
Upstream of East Roseville Parkway crossing	3/31/99	+	--
Behind Sierra College	4/1/99	+	--
Brace Road crossing	4/1/99	+	+
Brace Road crossing	5/7/99	+	+
Brace Road crossing	6/8/99	--	+
Horseshoe Bar Road crossing	5/5/99	--	+
Loomis Basin Park south, reach 1	4/2/99	--	+
Loomis Basin Park south, reach 2	4/2/99	--	+
Loomis Basin Park north at King Road	4/27/99	--	+
L.D.S. Recreation Park off Penryn Road	4/29/99	--	+
China Mine Road crossing	5/4/99	--	+
Buckeye Road off Penryn-Rock Springs Road	4/27/99	--	+
Upstream of Gilardi Road crossing	4/28/99	--	+

Table 11. Spatial and temporal distribution (+ = present; - = absent) of juvenile chinook salmon and steelhead in Secret Ravine during fall 1998 and 2000 at various sampling locations.

Location	Sampling Date	Chinook	Steelhead
Upstream of East Roseville Parkway crossing	10/28/00	--	--
Loomis Basin Park south, reach 1	11/5/98	--	--
Loomis Basin Park south, reach 2	11/5/98	--	--
L.D.S. Recreation Park off Penryn Road	11/5/98	--	+
Upstream of Gilardi Road crossing, reach 1	10/28/00	--	+
Upstream of Gilardi Road crossing, reach 2	10/28/00	--	+

Source: Memoranda from CDFG Biologist Rob Titus dated November 5, 2001 and February 5, 2003, CDFG, Region 2 files.

F. Fish Passage or Screening Data

No formal assessment of fish passage or screening issues has been completed for Secret Ravine. However, several investigators have suggested potential problems could prevent or hinder adult anadromous fish migration into and throughout Secret Ravine. These potential problems include:

- In Eric Gerstung's memorandum documenting his 1964 salmon spawning survey, he notes a waterfall in the upper watershed that limits salmon passage (see Figure 10 in this report above) but provided no information about the configuration of the falls and whether or not it was a complete barrier or only under certain conditions. It is impossible to determine the exact location of the falls, based on the scale and precision of Figure 5. This potential barrier may not even still exist, but confirmation of the continued presence and potential influence on anadromous fish migration rate and access to suitable habitats is needed.

- Near the mouth of Secret Ravine is an old pipeline crossing consisting of concrete abutments, an old wood surfaced bridge, and a concrete sill across the stream channel. This sill could be a complete barrier or impede passage during certain low flow conditions. This problem is well documented and it is scheduled for remediation in the next several years.

- Low flows during the spawning migration, particularly for fall-run chinook salmon, have been identified as a potential passage problem. The concern is well documented in the Dry Creek Conservancy's *Secret Ravine Adaptive Management Plan: A Placer County Tributary of the Dry Creek Watershed*. Flows in Secret Ravine and Miners Ravine are controlled by water management practices of PG&E and Placer County Water Agency. Any changes in their water management practices, water deliveries, or initiatives to increase water use efficiency (e.g., lining canals with impervious surfaces) could have significant impacts on the suitability of streams in western Placer County to support anadromous fish populations.

As with other streams in western Placer County, the presence of beaver populations and their resulting dams always pose a potential problem for migrating adult salmonids. Although beaver dams are not generally identified as a major problem on Secret Ravine, Wayne Fields, who helped complete the Stacy Li led habitat assessment of Secret Ravine in September of 1999, has indicated that they saw several smaller beaver dams during their survey, but that they also saw at least one major dam that Fields believes would have been a total barrier to fish passage. Again, management of beaver populations and beaver dams to facilitate fish passage on an annual basis is needed.

APPENDIX SECRET RAVINE 1

BENTHIC MACROINVERTEBRATE DATA
COLLECTED BY THE DRY CREEK CITIZENS GROUP

and

BENTHIC MACROINVERTEBRATE DATA
COLLECTED BY
Wayne C. Fields, Hydrozoology, 1999

Secret Ravine Benthic Macroinvertebrate Samples 2000

SAMPLING STATION:			Secret Ravine 2000				Secret Ravine Gravel Site 2000			
REPLICATE #	TV	FFG	45	46	47	Total	57			Total
PHYLUM ARTHROPODA										
Class Insecta										
Coleoptera (Larvae)										
Elmidae	4	c								
Dubiraphia sp.	6	c								
Microcylloepus sp.	4	c								
Diptera										
Ceratopogonidae	6	p								
Bezzia sp./ Palpomyia sp.	6	p								
Dasyhelea sp. (pupa)	6	nf								
Chironomidae	6									
Chironominae										
Chironomini	6	c					4			
Pseudochironomini	5	c								
Tanytarsini	6	c	83	113	43	239	14			
Orthocladiinae	5	c	19	9	20	48	27			
Tanypodinae	7	p								
Empididae	6	p								
Clinocera sp.	6	p								
Hemerodromia sp.	6	p		1		1	1			
Neoplasta sp.	6	p		1	1	2				
Muscidae	6	p					1			
Limnophora sp.	6	p								
Simuliidae	6	f								
Simulium sp.	6	f	2	77	142	221	37			
Tipulidae	3									
Limonia sp.	6	s								
Hemiptera										
Corixidae	8	p								
Sigara sp.	8	p								
Megaloptera										
Sialidae	4	p								
Sialis sp.	4	p								
Odonata										
Calopterygidae	5	p								
Hetaerina sp.	6	p		1		1				
Coenagrionidae		p								
Argia sp.	7	p	2	3		5	8			
Gomphidae	4	p								
Ophiogomphus occidentis.	4	p	2		1	3	9			

Libellulidae	9	p								
Brechmorhoga mendax	9	p	2	1		3	13			
Lepidoptera										
Nepticulidae		s			1	1				
Pyralidae	5									
Petrophila sp.	5	g	2	1		3	1			
Ephemeroptera										
Baetidae	4	g								
Baetis sp.	5	c	15	30	21	66	39			
Camelobaetidius sp.	4	c								
Fallceon quilleri	4	c	2	2	1	5	3			
Caenidae	7	c								
Caenis sp.	7	c								
Ephemerellidae	1	c								
Eurylophella lodi	1	c								
Leptohyphidae	4	c								
Tricorythodes minutus	4	c	3	1	1	5	57			
Plecoptera										
Chloroperlidae	1	p	1			1	2			
Perlodidae	2	p								
Isoperla sp.	2	p								
Trichoptera										
Glossosomatidae	0	g								
Protoptila coloma	1	g					9			
Helicopsychidae	3	g								
Helicopsyche borealis	3	g					1			
Hydropsychidae	4	f								
Hydropsyche californica	4	f	3	18	21	42	18			
Hydroptilidae	4	g								
Hydroptila sp.	6	g								
Leucotrichia pictipes	6	g	2			2				
Ochrotrichia sp.	4	c								
Oxyethira sp.	3	c			1	1				
Lepidostomatidae	1	s								
Lepidostoma sp.	1	s								
Leptoceridae	4	c								
Mystacides alafimbriata	4	c								
Nectopsyche gracilis	3	c								
Triaenodes/Ylodes sp.	6	s								
Philopotamidae	3	f								
Chimarra sp.	4	f								
Wormaldia sp.	3	f		1		1				
Subphylum Chelicerata										
Class Arachnoidea										

Acari										
Hygrobatidae	8	p								
Hygrobates sp.	8	p			1	1				
Megapella sp.	8	p								
Lebertiidae	8	p								
Lebertia sp.	8	p	6			6				
Sperchontidae	8	p								
Sperchon sp.	8	p	8	4	5	17	5			
Torrenticolidae	5	p								
Torrenticola sp.	5	p								
Subphylum Crustacea										
Class Malacostraca										
Amphipoda										
Cragonyctidae	4	c								
Crangonyx sp.	4	c	2	1	3	6	3			
Stygobromus sp.	4	c		2		2				
Hyalellidae	8	c								
Hyalella sp.	8	c		1		1				
Decapoda										
Astacidae	8	c								
Pacifasticus lenisculus	6	c								
Class Ostracoda										
Ostracoda	8	c								
Cyprididae	8	c								
PHYLUM COELENTERATA										
Class Hydrozoa										
Hydroida										
Hyridae										
Hydra sp.	5	p								
PHYLUM MOLLUSCA										
Class Gastropoda										
Pulmonata										
Ancylidae	6	g								
Ferrissia sp.	6	g	5	5	2	12	2			
Lymnaeidae	6	g								
Fossaria sp.	8	g								
Physidae	8	g								
Physa sp./ Physella sp.	8	g					2			
Planorbidae	6	g								
Gyraulus sp.	8	g								
Helisoma sp.	6	g								
Micromenetus sp.	6	g		1		1				
Class Bivalvia										
Pelecypoda	8	f								
Corbiculidae	10	f								

Corbicula fluminea	10	f	23	2		25	12			
Sphaeriidae	8	f								
Pisidium sp.	8	f					1			
PHYLUM NEMATODA	5	p	2	2	1	5	1			
PHYLUM PLATYHELMINTHES										
Class Turbellaria										
Tricladida										
Planariidae	4	p								
Dugesia tigrina	4	p	3			3	8			
PHYLUM ANNELIDA										
Class Oligochaeta	5	c	18	24	25	67	22			
Megadrili	5	c								
PHYLUM NEMERTEA										
Class Enopla										
Tertastemmatidae										
Prostoma graecense	8	p	42	4	5	51	17			
Total			247	305	295	847	317	0	0	0
Taxa Richness			22	24	18	32	27	0	0	0
Percent Dominant Taxon			34	37	48	28	18	#DIV/0!	#DIV/0!	#DIV/0!
EPT Taxa			6	5	5	8	7	0	0	0
EPT Index (%)			10.5	17.0	15.3	14.5	40.7	#DIV/0!	#DIV/0!	#DIV/0!
Sensitive EPT Index			0.4	0.3	0.3	0.4	3.8	#DIV/0!	#DIV/0!	#DIV/0!
Ephemeroptera Taxa			3.0	3.0	3.0	3.0	3.0	0.0	0.0	0.0
Plecoptera Taxa			1.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0
Trichoptera Taxa			2.0	2.0	2.0	4.0	3.0	0.0	0.0	0.0
Dipteran Taxa			3.0	5.0	4.0	5.0	6.0	0.0	0.0	0.0
Percent Dipteran			42.1	65.9	69.8	60.3	26.5	#DIV/0!	#DIV/0!	#DIV/0!
Non-Insect Taxa			9.0	10.0	7.0	13.0	10.0	0.0	0.0	0.0
Percent Non-Insect			44.1	15.1	14.2	23.3	23.0	#DIV/0!	#DIV/0!	#DIV/0!
Percent Chironomidae			41.3	40.0	21.4	33.9	14.2	#DIV/0!	#DIV/0!	#DIV/0!
Percent Hydropsychidae			1.2	5.9	7.1	5.0	5.7	#DIV/0!	#DIV/0!	#DIV/0!
Percent Baetidae			6.9	10.5	7.5	8.4	13.2	#DIV/0!	#DIV/0!	#DIV/0!
Shannon Diversity			2.3	2.0	1.8	2.2	2.7	0.0	0.0	0.0
Tolerance Value			6.5	5.7	5.6	5.9	5.4	#DIV/0!	#DIV/0!	#DIV/0!
Percent Intolerant (0-2)			0.4	0.0	0.0	0.1	3.5	#DIV/0!	#DIV/0!	#DIV/0!
Percent Tolerant (8-10)			32.8	3.9	3.7	12.3	15.8	#DIV/0!	#DIV/0!	#DIV/0!
Percent Collectors			57.5	60.0	39.0	51.9	53.3	#DIV/0!	#DIV/0!	#DIV/0!
Percent Filterers			11.3	32.1	55.3	34.1	21.5	#DIV/0!	#DIV/0!	#DIV/0!
Percent Grazers			3.6	2.3	0.7	2.1	4.7	#DIV/0!	#DIV/0!	#DIV/0!
Percent Predators			27.5	5.6	4.7	11.7	20.5	#DIV/0!	#DIV/0!	#DIV/0!
Percent Shredders			0.0	0.0	0.3	0.1	0.0	#DIV/0!	#DIV/0!	#DIV/0!
Total Percentages			100.0	100.0	100.0	100.0	100.0	#DIV/0!	#DIV/0!	#DIV/0!
Total Abundance			247	563	787		317			

Secret Ravine Benthic Macroinvertebrate CSBP Summary Metrics, 2000			
	Secret Ravine		
	2000		
	Mean	CV	Total
Taxa Richness	21.3	14.3	32.0
Percent Dominant Taxon	39.6	19.2	28.2
EPT Taxa	5.3	10.8	8.0
EPT Index (%)	14.3	23.6	14.5
Sensitive EPT Index	0.4	11.6	0.4
Ephemeroptera Taxa	3.0	0.0	3.0
Plecoptera Taxa	0.3	173.2	1.0
Trichoptera Taxa	2.0	0.0	4.0
Dipteran Taxa	4.0	25.0	5.0
Percent Dipteran	59.3	25.3	60.3
Non-Insect Taxa	8.7	17.6	13.0
Percent Non-Insect	24.5	69.5	23.3
Percent Chironomidae	34.2	32.6	33.9
Percent Hydropsychidae	4.7	65.7	5.0
Percent Baetidae	8.3	23.4	8.4
Shannon Diversity	2.0	12.3	2.2
Tolerance Value	5.9	7.9	5.9
Percent Intolerant (0-2)	0.1	173.2	0.1
Percent Tolerant (8-10)	13.5	124.0	12.3
Percent Collectors	52.2	22.0	51.9
Percent Filterers	32.9	66.8	34.1
Percent Grazers	2.2	67.3	2.1
Percent Predators	12.6	102.4	11.7
Percent Shredders	0.1	173.2	0.1

Secret Ravine Benthic Macroinvertebrate Samples 2001													
			Secret Ravine @ Miner's Ravine				Secret Ravine @ Sierra College			
SAMPLING STATION:			2001				2001			
REPLICATE #	TV	FFG	58	59	60	Total	70	71	72	Total
PHYLUM ARTHROPODA										
Class Insecta										
Coleoptera (Larvae)										
Elmidae	4	c								
Dubiraphia sp.	6	c					1			1
Microcylloepus sp.	4	c	3			3				
Diptera										
Ceratopogonidae	6	p								
Bezzia sp./ Palpomyia sp.	6	p								
Dasyhelea sp. (pupa)	6	nf								
Chironomidae	6									
Chironominae										
Chironomini	6	c								
Pseudochironomini	5	c								
Tanytarsini	6	c	55	97	106	258	69	18	32	119
Orthocladiinae	5	c	43	16	7	66	23	11	26	60
Tanypodinae	7	p	1			1	2	1	1	4
Empididae	6	p								
Clinocera sp.	6	p						1		1
Hemerodromia sp.	6	p								
Neoplasta sp.	6	p								
Muscidae	6	p								
Limnophora sp.	6	p								
Simuliidae	6	f								
Simulium sp.	6	f	28	14	49	91	19	149	39	207
Tipulidae	3									
Limonia sp.	6	s			1	1				
Hemiptera										
Corixidae	8	p								
Sigara sp.	8	p								
Megaloptera										
Sialidae	4	p								
Sialis sp.	4	p								
Odonata										
Calopterygidae	5	p								
Hetaerina sp.	6	p						1		1
Coenagrionidae		p								
Argia sp.	7	p	9	17	5	31	5	3	4	12
Gomphidae	4	p								

		Ophiogomphus occidentis.	4	p	3	1	4	8			3	3
	Libellulidae		9	p								
		Brechmorhoga mendax	9	p		2	2	4	3	6	6	15
Lepidoptera												
	Nepticulidae			s								
	Pyralidae		5									
		Petrophila sp.	5	g		5	3	8			2	2
Ephemeroptera												
	Baetidae		4	g								
		Baetis sp.	5	c	7	6	1	14	15	14	25	54
		Camelobaetidius sp.	4	c								
		Fallceon quilleri	4	c		1		1	4	1	1	6
	Caenidae		7	c								
		Caenis sp.	7	c								
	Ephemerellidae		1	c								
		Eurylophella lodi	1	c								
	Leptohyphidae		4	c								
		Tricorythodes minutus	4	c			1	1	4	1	2	7
Plecoptera												
	Chloroperlidae		1	p								
	Perlodidae		2	p								
		Isoperla sp.	2	p						1	1	2
Trichoptera												
	Glossosomatidae		0	g								
		Protoptila coloma	1	g					1			1
	Helicopsychidae		3	g								
		Helicopsyche borealis	3	g							1	1
	Hydropsychidae		4	f								
		Hydropsyche californica	4	f	14	11	8	33	9	15	17	41
	Hydroptilidae		4	g								
		Hydroptila sp.	6	g					2			2
		Leucotrichia pictipes	6	g	1			1			6	6
		Ochrotrichia sp.	4	c					4		3	7
		Oxyethira sp.	3	c		2		2	1			1
	Lepidostomatidae		1	s								
		Lepidostoma sp.	1	s								
	Leptoceridae		4	c								
		Mystacides alafimbriata	4	c					1			1
		Nectopsyche gracilis	3	c	1			1			2	2
		Triaenodes/Ylodes sp.	6	s								
	Philopotamidae		3	f								
		Chimarra sp.	4	f			1	1	5	25	24	54
		Wormaldia sp.	3	f						1		1
Subphylum Chelicerata												

Class Arachnoidea										
Acari										
Hygrobatidae	8	p								
Hygrobates sp.	8	p								
Megapella sp.	8	p								
Lebertiidae	8	p								
Lebertia sp.	8	p	3	3		6				
Sperchontidae	8	p								
Sperchon sp.	8	p	6	4	1	11	9		3	12
Torrenticolidae	5	p								
Torrenticola sp.	5	p								
Subphylum Crustacea										
Class Malacostraca										
Amphipoda										
Cragonyctidae	4	c								
Crangonyx sp.	4	c	3	2	9	14	4	2		6
Stygobromus sp.	4	c								
Hyalellidae	8	c								
Hyalella sp.	8	c					6			6
Decapoda										
Astacidae	8	c								
Pacifasticus lenisculus	6	c								
Class Ostracoda										
Ostracoda	8	c								
Cyprididae	8	c								
PHYLUM COELENTERATA										
Class Hydrozoa										
Hydroida										
Hyridae										
Hydra sp.	5	p			1	1				
PHYLUM MOLLUSCA										
Class Gastropoda										
Pulmonata										
Ancylidae	6	g								
Ferrissia sp.	6	g	7	11	19	37	2			2
Lymnaeidae	6	g								
Fossaria sp.	8	g								
Physidae	8	g								
Physa sp./ Physella sp.	8	g					1		2	3
Planorbidae	6	g								
Gyraulus sp.	8	g								
Helisoma sp.	6	g								
Micromenetus sp.	6	g	10	6	5	21	11	1	2	14
Class Bivalvia										
Pelecypoda	8	f								

Corbiculidae	10	f								
Corbicula fluminea	10	f	5	15	21	41	11	1	24	36
Sphaeriidae	8	f								
Pisidium sp.	8	f	1			1	5			5
PHYLUM NEMATODA	5	p	2	6	9	17	10	6	17	33
PHYLUM PLATYHELMINTHES										
Class Turbellaria										
Tricladida										
Planariidae	4	p								
Dugesia tigrina	4	p	3	8	2	13	17	13	14	44
PHYLUM ANNELIDA										
Class Oligochaeta	5	c	54	90	56	200	47	25	15	87
Megadrili	5	c								
PHYLUM NEMERTEA										
Class Enopla										
Tertastemmatidae										
Prostoma graecense	8	p	32	18	8	58	18	5	9	32
Total			291	335	319	945	309	301	281	891
Taxa Richness			22	21	22	30	29	22	26	38
Percent Dominant Taxon			19	29	33	27	22	50	14	23
EPT Taxa			4	4	4	8	10	7	10	15
EPT Index (%)			7.9	6.0	3.4	5.7	14.9	19.3	29.2	20.9
Sensitive EPT Index			0.3	0.6	0.0	0.3	0.6	0.7	1.4	0.9
Ephemeroptera Taxa			1.0	2.0	2.0	3.0	3.0	3.0	3.0	3.0
Plecoptera Taxa			0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0
Trichoptera Taxa			3.0	2.0	2.0	5.0	7.0	3.0	6.0	11.0
Dipteran Taxa			4.0	3.0	4.0	5.0	4.0	5.0	4.0	5.0
Percent Dipteran			43.6	37.9	51.1	44.1	36.6	59.8	34.9	43.9
Non-Insect Taxa			11.0	10.0	10.0	12.0	12.0	7.0	8.0	12.0
Percent Non-Insect			43.3	48.7	41.1	44.4	45.6	17.6	30.6	31.4
Percent Chironomidae			34.0	33.7	35.4	34.4	30.4	10.0	21.0	20.5
Percent Hydropsychidae			4.8	3.3	2.5	3.5	2.9	5.0	6.0	4.6
Percent Baetidae			2.4	2.1	0.3	1.6	6.1	5.0	9.3	6.7
Shannon Diversity			2.4	2.3	2.2	2.4	2.8	2.0	2.8	2.7
Tolerance Value			5.8	5.9	6.0	5.9	5.8	5.5	5.7	5.7
Percent Intolerant (0-2)			0.0	0.0	0.0	0.0	0.3	0.3	0.4	0.3
Percent Tolerant (8-10)			16.2	12.5	10.0	12.8	17.2	4.0	15.7	12.2
Percent Collectors			57.0	63.9	56.4	59.3	57.9	23.9	37.7	40.1
Percent Filterers			16.5	11.9	24.8	17.7	15.9	63.5	37.0	38.6
Percent Grazers			6.2	6.6	8.5	7.1	5.5	0.3	4.6	3.5
Percent Predators			20.3	17.6	10.0	15.9	20.7	12.3	20.6	17.8
Percent Shredders			0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0
Total Percentages			100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Total Abundance			499	335	696		1059	1806	1124	

Secret Ravine Benthic Macroinvertebrate CSBP Summary Metrics, 2001						
	Secret Ravine @ Miner's Ravine			Secret Ravine @ Sierra College		
	2001			2001		
	Mean	CV	Total	Mean	CV	Total
Taxa Richness	21.7	2.7	30.0	25.7	13.7	38.0
Percent Dominant Taxon	27.0	27.2	27.3	28.6	65.1	23.2
EPT Taxa	4.0	0.0	8.0	9.0	19.2	15.0
EPT Index (%)	5.8	38.7	5.7	21.1	34.7	20.9
Sensitive EPT Index	0.3	95.6	0.3	0.9	48.6	0.9
Ephemeroptera Taxa	1.7	34.6	3.0	3.0	0.0	3.0
Plecoptera Taxa	0.0	#DIV/0!	0.0	0.7	86.6	1.0
Trichoptera Taxa	2.3	24.7	5.0	5.3	39.0	11.0
Dipteran Taxa	3.7	15.7	5.0	4.3	13.3	5.0
Percent Dipteran	44.2	15.0	44.1	43.7	31.8	43.9
Non-Insect Taxa	10.3	5.6	12.0	9.0	29.4	12.0
Percent Non-Insect	44.3	8.8	44.4	31.3	44.8	31.4
Percent Chironomidae	34.4	2.6	34.4	20.5	50.0	20.5
Percent Hydropsychidae	3.5	33.2	3.5	4.6	34.3	4.6
Percent Baetidae	1.6	70.4	1.6	6.8	32.5	6.7
Shannon Diversity	2.3	5.6	2.4	2.5	18.6	2.7
Tolerance Value	5.9	1.0	5.9	5.7	2.4	5.7
Percent Intolerant (0-2)	0.0	#DIV/0!	0.0	0.3	5.0	0.3
Percent Tolerant (8-10)	12.9	23.8	12.8	12.3	58.8	12.2
Percent Collectors	59.1	7.0	59.3	39.9	42.9	40.1
Percent Filterers	17.7	36.7	17.7	38.8	61.5	38.6
Percent Grazers	7.1	17.3	7.1	3.5	79.3	3.5
Percent Predators	16.0	33.3	15.9	17.9	27.1	17.8
Percent Shredders	0.1	173.2	0.1	0.0	#DIV/0!	0.0

Wayne C. Fields -- Secret Ravine Baseline Macroinvertebrate Samples, September 1999

TAXON			HABITAT UNIT AND NUMBER COLLECTED											
			3	5	93	97	251	253	318	322	492	505	618	629
Phylum Platyhelminthes														
Family Planariidae	/*Dugesia tigrina*	1	16	19	23	37	2	1	17	7	3	2		
P. Nemertea														
F. Tetrastemmatidae	/*Prostoma graecense*		1	4	13	9	12	12	1		20	1	19	23
P. Nematoda														
F. Mermithidae	/unidentified species A		1	1	1							3	1	3
	/uid species B			1	1								1	
P. Annelida														
Class Oligochaeta														
Order Tubificida														
F. Naididae	/*Nais alpina*			1				3	42	42	1	6	40	28
	/*N. communis/variabili*	*s*	12	3	3	1	3							
	/*N. pardalis*		15	7	3		2		5	5	2			
	/*Slavina appendiculata*		86	112	4		11	10		1	1	1	1	9
F. Tubificidae	/*Aulodrilus pigueti*		1											
	/*Bothrioneurum vejdovskyanum*			1					2					
	/*Limnodrilus hoffmeisteri*											4		
F. Enchytraeidae	/uid species A								1					
	/uid species B								2					
F. Megascolecidae	/uid species	4	5	4	2	28	23	1	6	18	5	2	2	
O. Lumbriculida														
F. Lumbriculidae	/*Lumbriculus variegatus*											1		
P. Arthropoda														
Cl. Crustacea														
F. Crangonyctidae	/*Synurella* sp.	4	2							2	1	6	2	
Cl. Insecta														
O. Ephemeroptera														
F. Baetidae	/*Baetis tricaudatus*	47	105	14	20	58	18	42	73	31	49	40	51	

Secret Ravine Baseline Macroinvertebrate Samples, September 1999

TAXON			HABITAT UNIT AND NUMBER COLLECTED											
			3	5	93	97	251	253	318	322	492	505	618	629
F. Baetidae	/*Fallceon quilleri*		1	1	16	3	5	3	1		6	2	1	1
	/*Procloeon* sp.												3	
F. Heptageniidae	/*Heptagenia* sp.						1			2	1	2		
F. Tricorythidae	/*Tricorythodes minutus*		1	2	62	5	9	8	20	62	44	27	66	39
O. Odonata														
F. Gomphidae	/*Ophiogomphus occidentis*	1	1	8	7	8	5	3	5	14	8	3		
F. Libellulidae	/*Brechmorhoga mendax*			4	6	6	20	30	6	13	31	57	15	10
F. Calopterygidae	/*Hetaerina americana*				1								1	
F. Coenagrionidae	/*Argia vivida*	2	2	24	3	9	5	5	12	6	8	6	46	
O. Plecoptera														
F. Nemouridae	/*Malenka* sp.													1
O. Trichoptera														
F. Glossosomatidae	/*Glossosoma* sp.		1		1	1	1	1		2				
	/*Protoptila coloma*	3	5	21	71	79	94	4	3	47	75	55	1	
F. Helicopsychidae	/*Helicopsyche borealis*				2	6	21							
F. Hydropsychidae	/*Hydropsyche californica*		6	16	17	34	6	3	7	10	45	11	23	16
F. Hydroptilidae	/*Hydroptila* sp.		11	2	1									
	/*Leucotrichia pictipes*			1					2	2	1	5		
	/*Ochrotrichia* sp.							3	1			1	1	
F. Leptoceridae	/*Nectopsyche gracilis*				5	3			1	1			1	
F. Philopotamidae	/*Chimarra* sp.					11	6	26	11	2				
	/*Wormaldia* sp.		1			2	2	2			3			12
O. Lepidoptera														
F. Pyralidae	/*Parapoynx* sp.									1				
	/*Petrophila* sp.		4	3					1					

Secret Ravine Baseline Macroinvertebrate Samples, September, 1999

TAXON		HABITAT UNIT AND NUMBER COLLECTED											
		3	5	93	97	251	253	318	322	492	505	618	629
O. Coleoptera													
F. Elmidae	/*Cleptelmis* sp.						1						
	/*Dubiraphia* sp.		1										
O. Diptera													
F. Ceratopogonidae	/*Atrichopogon* sp.					1							
F. Chironomidae	/*Pentaneura* sp. 1												
	/*Micropsectra* sp. A										1		4
	/*Micropsectra* sp. B	8	3	3		1			3		1		
	/*Paratanytarsus* sp.						1				1		
	/*Rheotanytarsus* sp.	69	20	24	1	3	2	2	7	6	4	2	8
	/*Polypedilum* sp. A5						1	3				3	
	/*Polypedilum* sp. B							1	1				
	/*Robackia demeijerei*						2				2		
	/*Stenochironomus* sp.							1	2				
	/*Pagastia* sp.					1		1					
	/*Brillia* sp.								2				1
	/*Cardiocladius* sp. 1												
	/*Corynoneura* sp.	1			1		1	2	1				
	/*Cricotopus bicinctus*		1	2	1				1				
	/*Eukiefferiella* sp. 1												
	/*Orthocladius dentifer*	2		5	2		1						2
	/*Parametriocnemus* sp.						2	2					
	/*Rheocricotopus* sp.	1					1		2	1			2
	/*Thienemanniella* sp.	3	3				1	1			1	1	1
F. Psychodidae	/*Maruina* sp.	7						1					
F. Simuliidae	/*Simulium argus*	11	7	1		7	1	32	12	1	1		9
	/*S. aureum*	1	1			1		9	22	5	2	2	13
F. Tipulidae	/*Dicranota* sp.										1		
	/*Tipula* sp.												
F. Empididae	/*Hemerodromia* sp.				3			2	5		1	3	2

Secret Ravine Baseline Macroinvertebrate Samples, September, 1999

TAXON			HABITAT UNIT AND NUMBER COLLECTED											
			3	5	93	97	251	253	318	322	492	505	618	629
Cl. Arachnida														
O. Hydracarina														
F. Lebertiidae	/*Lebertia* sp.				1	1								
F. Sperchontidae	/*Sperchon* sp.	4	1	5	1	3	5	4	2	7	1	1	5	
F. unknown	/uid mite species A	1												
P. Mollusca														
Cl. Gastropoda														
F. Planorbidae	/*Micromenetus dilatatus*	1	2	1										
F. Physidae	/*Physa gyrina*				1	2				1	1			
F. Ancylidae	/*Ferrissia rivularis*	1	1	4		2	5				1	1	1	
Cl. Bivalvia														
F. Sphaeriidae	/*Pisidium casertanum*					1								
F. Corbiculidae	/*Corbicula fluminea*		2	1	35	15	1			1	2	2	3	2
TOTAL SPECIES: 73			32	31	31	25	26	25	34	33	27	30	27	33
TOTAL ORGANISMS:	3543		308	319	314	217	314	300	235	320	317	289	305	305
PERCENT SIMILARITY:			83.3		47.6		89.7		84.7		80.2		69.8	

APPENDIX A

WATER TEMPERATURE CRITERIA
LITERATURE AND DATA DOCUMENTATION
CHINOOK SALMON AND STEELHEAD TROUT

Chinook salmon literature summary of effects of different water temperature on various life history stages.

Life Stage	Water Temp. °C	Water Temp. °F	Mortality (%)	Survive	Reference
Egg incubation	13.3	56	0	Yes	Restoring Central Valley Streams: A Plan for Action. California Department of Fish and Game November 1993.
Egg incubation	14.4	58	100	No	Loudermilk, W.E. 1996. Fall-run chinook salmon egg deposition and exposure to lethal water temperatures in the designated salmon spawning area of the lower Stanislaus River. DFG Exhibit 96-6. Submitted to the State Water Resources Control board by the Department of Fish and Game in January 1996 regarding Water Right Change Petitions filed by Calaveras County Water District.
Egg and fry development (CNFH)	15.6-16.1	60-61	80% or more	Yes	Healey, T.P. 1979. The effect of high temperature on the survival of Sacramento River chinook (king) salmon, *Oncorhynchus tshawytscha*, eggs and fry. Administrative Report No. 79-10. Anadromous Fisheries Branch, California Department of Fish and Game, Sacramento, CA.
Egg and fry development	<15.6	<60	Decreased	Yes	
Egg and fry development	6.4-14.2	43.5-57.5	Low	Yes	
Egg and fry development	>14.2	>57.5	Above Normal	Yes	
Egg incubation (eyed stage)(Nimbus FH)	>16.7	>62	100%	No	Hinze, J. A. 1959. Annual report Nimbus Salmon and Steelhead hatchery fiscal year of 1957-58. Inland Fisheries Administrative Report 59-4, California Department of Fish and Game. (Cited in Healey)
Egg incubation (eyed stage)	15.6-16.7	60-62	50%	Yes	
Egg incubation (eyed stage)	12.8-15.0	55-59	20%	Yes	
Eggs spawned at and Incubated at	15.6-16.7 12.8-13.3	60-62 55-56	30% to eyed stage	Yes	
Egg fertilization to emergence	13.3	56	0	Yes	U. S. Bureau of Reclamation. 1997. Central Valley Project Improvement Act, Draft Programmatic EIS, Technical Appendix Three, Sacramento, CA.
	13.8	57	10	Yes	
	14.4	58	20	Yes	
	15.0	59	45	Yes	
	15.6	60	88	Yes	
	16.1	61	97	Yes	
	16.7	62	100	No	
Juvenile rearing	15.6-23.9	60-75	Increasing Chronic Stress	Yes to No	U. S. Bureau of Reclamation. 1997. Central Valley Project Improvement Act, Draft Programmatic EIS, Technical Appendix Three, Sacramento, CA
Juvenile rearing	18.3	65	5	Yes	U. S. Bureau of Reclamation. 1997. Central Valley Project

	18.9 19.4 20.0 20.6 21.1 21.7 22.2	66 67 68 69 70 71 72	8 12 24 32 46 57 75	Yes Yes Yes Yes Yes Yes Yes	Improvement Act, Draft Programmatic EIS, Technical Appendix Three, Sacramento, CA. Interpolation from graphic
Smolt emigration	23.3-24.4	74-76	80-90+	Yes	U. S. Bureau of Reclamation. 1997. Central Valley Project Improvement Act, Draft Programmatic EIS, Technical Appendix Three, Sacramento, CA
Juvenile rearing (40-65 mm) (61-99 mm) (79-114 mm) (80-108 mm) (45-70 mm) (56-92 mm) (81-121 mm)	 18.0 19.5 20.2 20.8 21.0 22.0 22.5	 64.4 67.1 68.4 69.4 69.8 71.6 72.5		 Yes Yes Yes Yes Yes Yes Yes	Maslin, P. E., M. Lennox, J. Kindopp, and W. McKinney. 1997. Intermittent streams as rearing habitat for Sacramento River chinook salmon (*Oncorhynchus tshawytscha*). Dept. of Biological Sciences, California State University, Chico.
Smolt emigration (various in-Delta release groups)	20.0-22.2	68-72		Yes	Brandes, P. L., and J. S. McLain. 2001. Juvenile chinook salmon abundance, distribution, and survival in the Sacramento-San Joaquin Estuary, pp 39-136 in R. L. Brown, ed., Contributions to the Biology of Central Valley Salmonids, Volume 2. Fish Bulletin 179. California Department of Fish and Game, Sacramento, CA.
Adult migration	21.1-21.7	70-71		Yes, start of spawning run	Hallock, R. J., R. F. Elwell, and D.H. Fry, Jr. 1970. Migration of adult king salmon, *Oncorhynchus tshawytscha*, in the San Joaquin Delta, as demonstrated by the use of sonic tags. Fish Bulletin 151. California Department of Fish and Game, Sacramento, CA.

Steelhead trout literature summary of water temperature effects on various life history stages.

Life Stage	Water Temp. °C	°F	Mortality (%)	Survive	Reference
Egg incubation	13.3	56	Begins to increase	Yes	McEwan, D. l.. 2001. Central Valley steelhead, pp 1-43 in R. L. Brown, ed., Contributions to the Biology of Central Valley Salmonids, Volume 1. Fish Bulletin 179. California Department of Fish and Game, Sacramento, CA. (cites others).
Juvenile rearing	18.9	66	Thermal stress begins	Yes	McEwan, D. l.. 2001. Central Valley steelhead, pp 1-43 in R. L. Brown, ed., Contributions to the Biology of Central Valley Salmonids, Volume 1. Fish Bulletin 179. California Department of Fish and Game, Sacramento, CA. (cites others).
Adults	21.1	70	Some	Yes	McEwan, D. l.. 2001. Central Valley steelhead, pp 1-43 in R. L. Brown, ed., Contributions to the Biology of Central Valley Salmonids, Volume 1. Fish Bulletin 179. California Department of Fish and Game, Sacramento, CA. (cites others).
Juvenile rearing	19+	66.2+		Yes	Demko, D. B. and S. P. Cramer. 1996. Effects of pulse flows on juvenile chinook migration in the Stanislaus River. 1996 Annual Report. S. PL Cramer and Associates, Inc., Gresham OR.
Spawning and egg incubation	7.7-11.1 11.2-14.2 14.2-16.1 >16.1	46-52 52.1-57.5 57.6-61 >61	Optimum Chronic low stress Chronic med. stress Chronic high stress		U. S. Bureau of Reclamation. 1997. Central Valley Project Improvement Act, Draft Programmatic EIS, Technical Appendix Three, Sacramento, CA. Cites others.
Juvenile rearing	12.8-15.6 15.6-20.0 20.1-22.5 >22.5	55-60. 60.1-68 68.1-72.5 >72.5	Optimum Chronic low stress Chronic med. stress Chronic high stress		U. S. Bureau of Reclamation. 1997. Central Valley Project Improvement Act, Draft Programmatic EIS, Technical Appendix Three, Sacramento, CA. Cites others.
Juvenile rearing	23.3	74		Yes	California Department of Fish and Game. 1967. Unpublished electrofishing data from Secret Ravine. Rainbow trout young of the year captured.
Juvenile emigration	6.9-11.3 11.3-15.2 15.2-17.3 >17.3	44.4-52.3 52.4-59.3 59.4-63.2 >63.2	Optimum Chronic low stress Chronic med. stress Chronic high stress		U. S. Bureau of Reclamation. 1997. Central Valley Project Improvement Act, Draft Programmatic EIS, Technical Appendix Three, Sacramento, CA. Cites others.